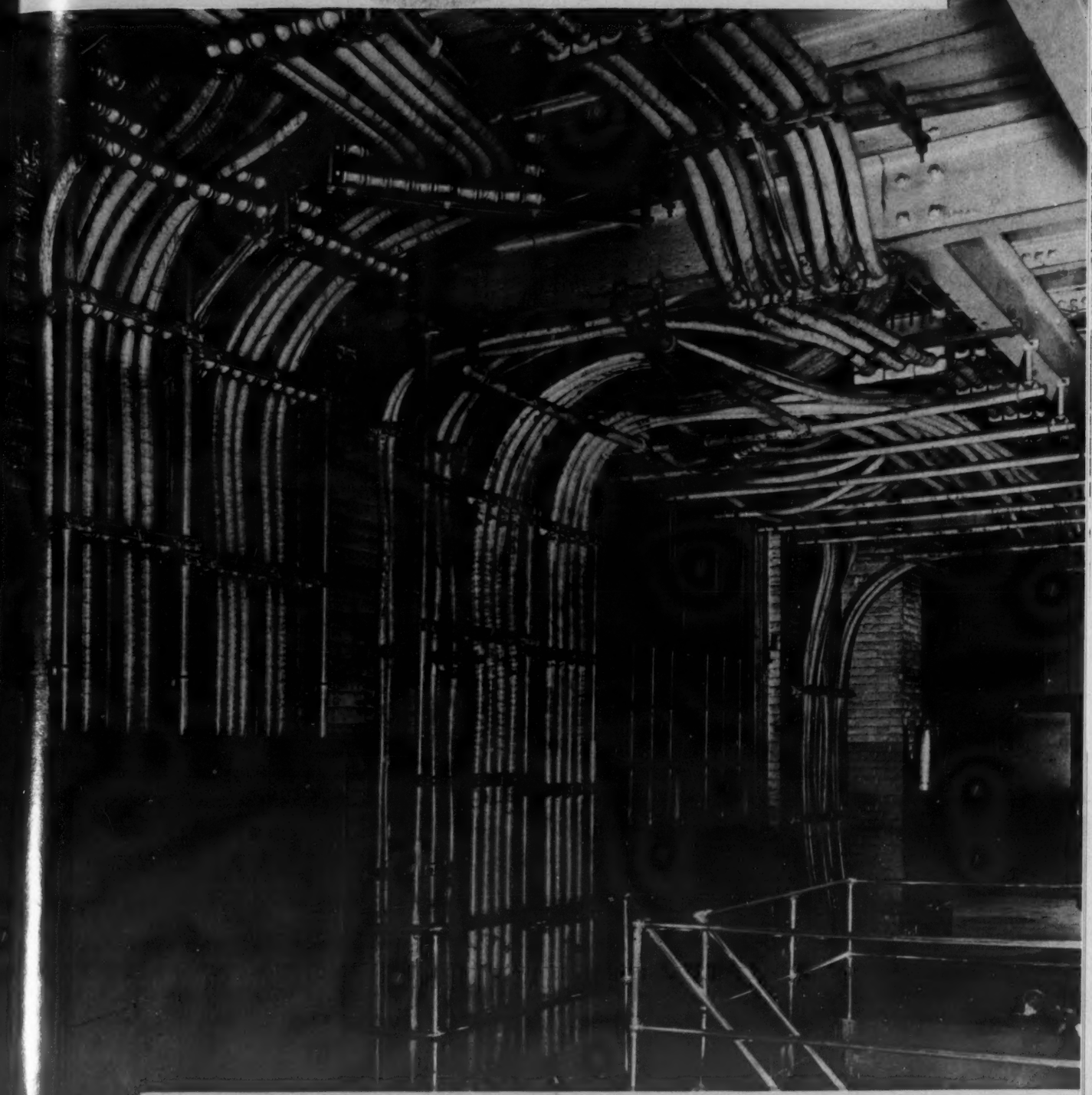
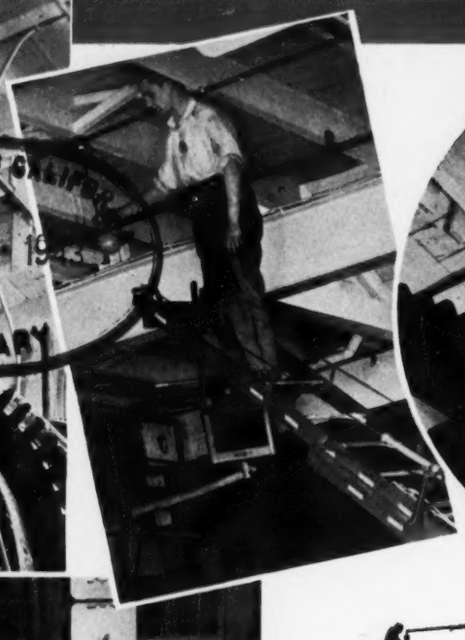
Electrical World

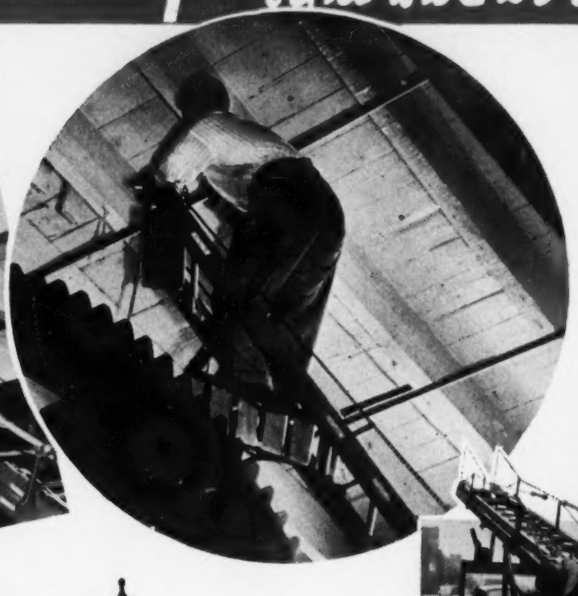
MAY 15, 1943



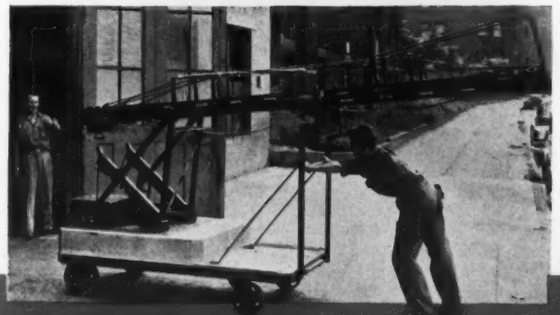
DO'S AND DON'TS OF CABLE INSTALLATION AND MAINTENANCE

Easy overhead servicing - without stops - in vital war work!





FAST SERVICING of indoor, high-overhead fluorescents, sprinkler heads or "what-have-you"—without stopping production, even where aisles are narrow—is accomplished with ease by reaching over bench or machine. Murray Crows'nests mounted on caster trailers or electric platform trucks are the last word in adaptiveness. Send for the convincing facts that have made this aerial ladder favorite among utilities for more than a decade. No obligation. Metropolitan Device Corporation, Brooklyn, New York.



INDOOR—OUTDOOR

Murray crows'nest

FOR MOUNTING ON CASTER TRAILERS, ELECTRIC PLATFORM TRUCKS OR STANDARD COMMERCIAL TRUCKS (¼ TON OR LARGER)

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

May 15, 1943 — Vol. 119, No. 20

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330 West 42nd Street, New York, N. Y.
Director of Circulation:

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To .....

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Signed .....

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LECTRICAL WORLD

ublished weekly. Price 25 cents a copy. Allow least ten days for change of address. Address communications about subscriptions to irector of Circulation, Electrical World, 330 est 42nd Street, New York, N. Y.

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ubscription rates: In the United States, exico, Central and South American counies, $5 a year, $8 for two years, $10 for three ears, Canada $5.50 for one year, $9 for two ears, $11 for three years (Canadian money t par). Great Britain and British possessions, shillings for one year, 108 shillings for ree years. All other countries $9 for one ear, $18 for three years. Entered as second-lass matter November 16, 1936, at Post Office t Albany, N. Y., under the Act of March 3, 879. Printed in U. S. A. Contents copyrighted, 943, by McGraw-Hill Publishing Company, nc. Branch Offices: 520 North Michigan venue, Chicago; 68 Post Street, San Francisco; ldwych House, Aldwych, London, W. C. 2; Washington, Philadelphia, Cleveland, Detroit, t. Louis, Boston, Los Angeles, Atlanta, Ga.

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HOW YESTERDAY'S CABLE RESEARCH HELPS WIN TODAY'S WAR

Battles may hang by threads ...OF GLASS!

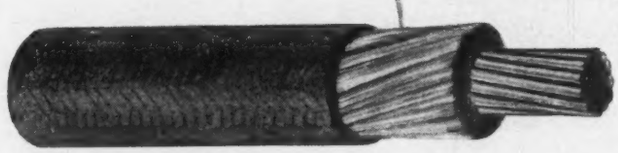
A decade ago, in 1932, Okonite was the first manufacturer to apply spun glass as a permanent heat-resisting insulation to electrical cables operating at high temperatures in boiler rooms, steam tunnels and other hot locations. This new insulation was named "OKOGLASS".

Profiting by this development, electric motor manufacturers were quick to adopt glass insulated magnet wires to permit higher temperature operation, with huge savings in steel parts and casings and a substantial reduction of over-all motor dimensions.

Today the weight and space saved by these smaller, lighter motors—and there are dozens in each bomber—has made possible changes in plane design that permit longer flights and heavier bomb loads.

OKOGLASS also supplements the limited supply of asbestos for electrical insulation and still enables us to produce flame-resisting cables for our battle fleets.

Thus, battles may hang by threads of glass as a result of Okonite's development of spun glass insulation for electrical cables. The weight saved by lighter electric motors may mean a quicker victory. The Okonite Company, Passaic, N. J. Offices in principal cities.



3290

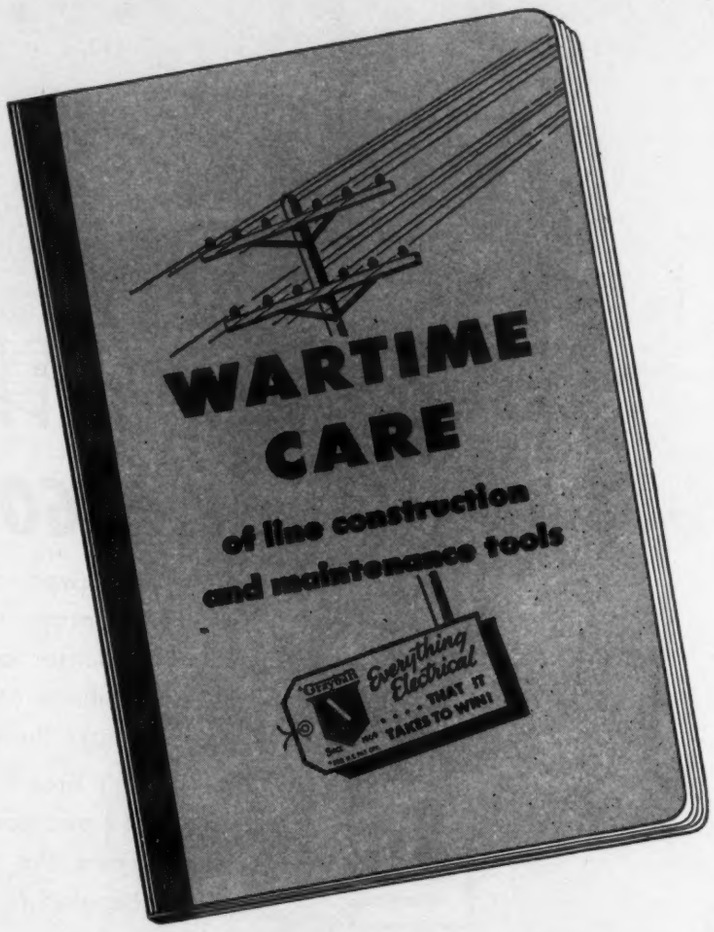
OKONITE Insulated Wires and Cables

HERE'S HELP ON TOOL CARE

NEW GRAYBAR POCKET MANUAL TELLS HOW TO GET LONGER SERVICE OUT OF LINE TOOLS

This practical new handbook fits the needs of everyone responsible for care and servicing of line tools and for employee training. On more than 30 separate items, it gives suggestions for use, advice on adjustment, lubrication, storage.

It has been prepared with the co-operation of leading makers of these supplies as a part of Graybar's complete service "from the top of the pole to the bottom of the hole". For your copy, just call your local Graybar Representative or mail coupon.



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LEATHER
RUBBER

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GRAYBAR ELECTRIC COMPANY
Graybar Building, New York

Gentlemen: Please send me a free copy of your new 32-page handbook "Wartime Care of Line Construction and Maintenance Tools".

Name_____ Title_____

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Address_____

City and State_____

Graybar

IN OVER 80 PRINCIPAL CITIES

OF A *GOOD* CONDENSER

From the viewpoint of the turbine, the condenser is a mighty important adjunct to good performance. This Elliott condenser looks good from its turbine floor, and its very definite contribution to overall unit efficiency helps to make the turbine look good.

Through broad experience, Elliott engineers have developed and confirmed condenser design principles which insure the success of Elliott installations. We should be glad to discuss these principles with you in relation to the next condenser you plan.

The Army-Navy E has been awarded to both the Jeannette and the Ridgway plants of Elliott Company.

ELLIOTT COMPANY
Heat Transfer Department, **JEANNETTE, PA.**
DISTRICT OFFICES IN PRINCIPAL CITIES

C-378

ELLIOTT *builds good* CONDENSERS

CHECK the FACTS

1. HI-PRESSURE, self-cleaning contact, one piece jaw and terminal.
2. Simple, rugged, efficient blade operating parts.
3. Weatherproof greaseless bearing for easy operation.

R&IE

Type TTR- DISCONNECTING SWITCH

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.
IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

The Check list -

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- AIR BREAK SWITCHES
- INTERRUPTER SWITCHES
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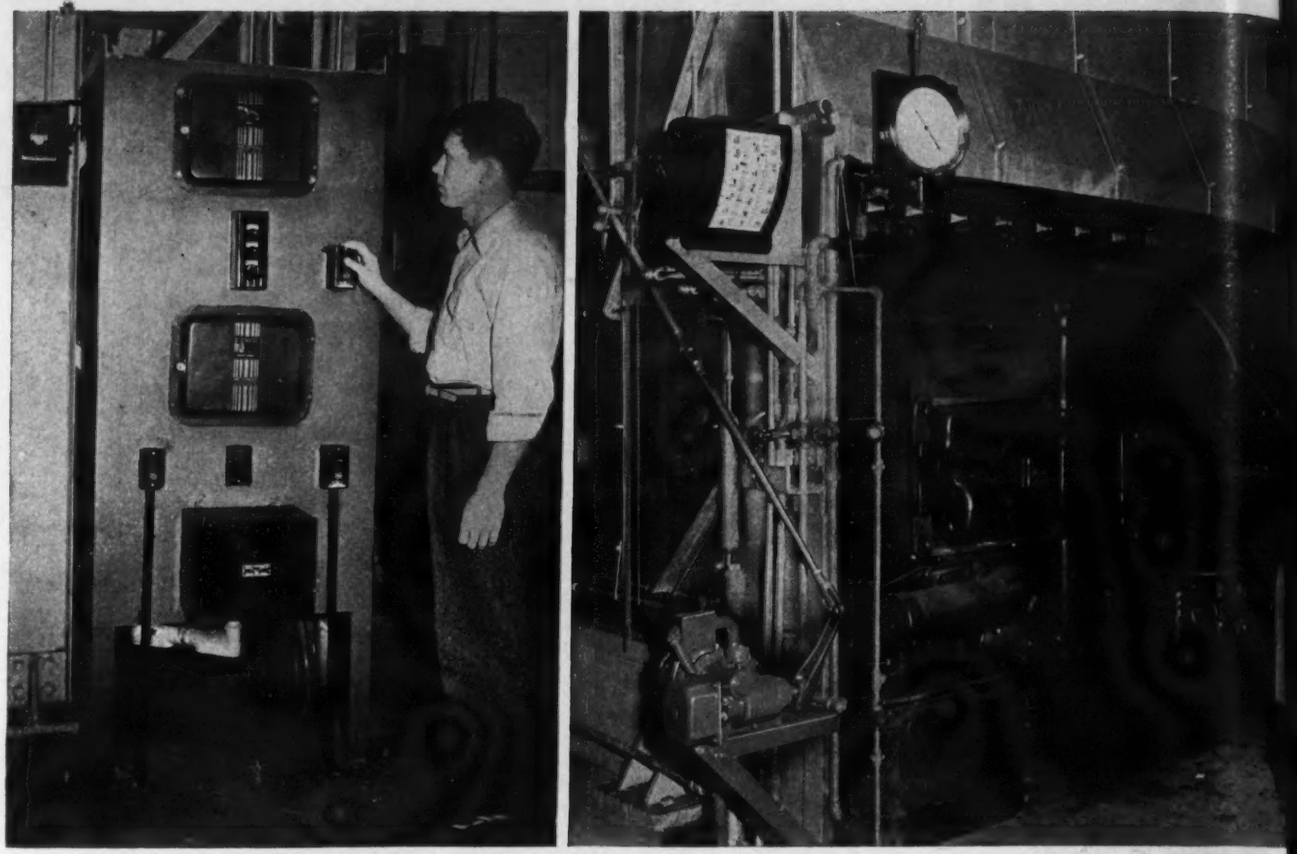
- TESTING DEVICES



L&N Type P Combustion Control on a B & W Integral-Furnace Boiler. Control Panel at left arrives completely assembled and ready for outside connection; carries the Master Controller, Furnace Pressure Controller and all push buttons. A typical valve drive is the one for uptake damper, shown alongside the boiler.

NEW COMBUSTION CONTROL SYSTEM Meets Needs of War-Busy Textile Plant

Shown here is a typical application of the entirely new L&N Type P Combustion Control system especially suited to the needs of "smaller" power plants and to many war plants:

1. It is Simple. One Controller (the Master) regulates both fuel and air for all boilers. Another Controller (one for each boiler) regulates furnace pressure. Both are entirely electrical; they move the dampers, valves and levers by means of electric-motored Drive Units.

2. It is Centralized and Flexible. Without moving from Panel, operator can switch from fully-automatic control to either base-load or push-button control; can operate some boilers on automatic control and some on push-button; can change fuel-air ratio of any boiler or boilers. In brief, he can suit the operation to the plant requirements.

3. One Drive Unit for each damper, etc.; no piping or shafting; no interconnecting linkages; connections of Unit to Control Panel are through an electrical conduit. Drive Units cannot be back-driven even when power is off; and all but the smallest can be equipped with hand-wheel drives if desired. Only power is from 110-volt a-c lighting or similar circuit.

4. Type P is Easy to Install. With no compressors, piping or line shafting, the labor and time of installing are minimum. Our factory assembly of the Control Panel further reduces installation costs. We can supply panel individually, or as part of group panel, or on boiler board which includes both control and instruments.

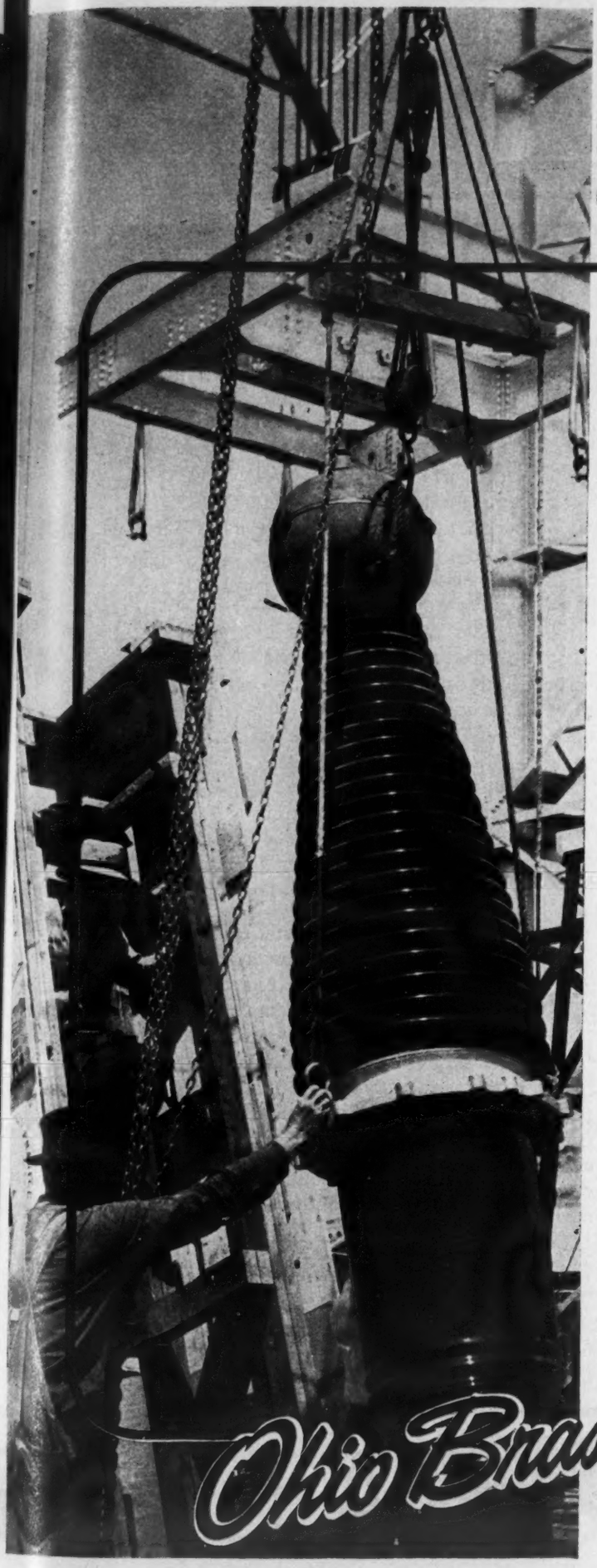
If you have a combustion-control problem which does not require central-station type equipment, outline the situation and we will promptly send specific facts about Type P Control.

Jrl Ad N-01P-163(3)

LEEDS & NORTHRUP COMPANY, 4938 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS • TELEMETERS • AUTOMATIC CONTROLS • HEAT-TREATING FURNACES



O-B's

LIGHT-TIGHT, AIR-TIGHT & OIL-TIGHT BUSHING SEAL

Preserves the Oil
Facilitates Handling and Storage
Stops Oil Leaks

In its simplest terms, O-B bushing construction may be described thus: "What's outside *stays out*--what's inside *stays in.*"

O-B bushings are totally light-tight. Even the gauge that indicates oil-level is operated magnetically so that a non-ferrous metal wall can block sunlight from striking a small area of the oil.

O-B bushings are totally air-tight. They do not breathe and, therefore, air-borne moisture cannot come into contact with the oil to cause deterioration.

O-B bushings are totally leak-proof. They are filled with the highest grade oil at the factory, can be handled and stored out doors in any position, and are ready for service immediately upon installation. Protective shells cover both ends, making the bushing a sealed unit. There is no interchange of oil between the bushing and apparatus tank.

All these precautions are taken to preserve the condition of the oil. The durable porcelain internal dielectric needs no such protection. It is completely moisture-proof.

Light-tight, air-tight, and oil-tight sealing is one of the refinements that have placed O-B bushings in the lead. To get bushings that have had troubles *designed* out of them, specify O-B.

★ KEEP BUYING WAR BONDS ★

Ohio Brass

MANSFIELD, OHIO
CANADIAN OHIO BRASS CO., LTD.
NIAGARA FALLS, ONTARIO

2410-H

File....but

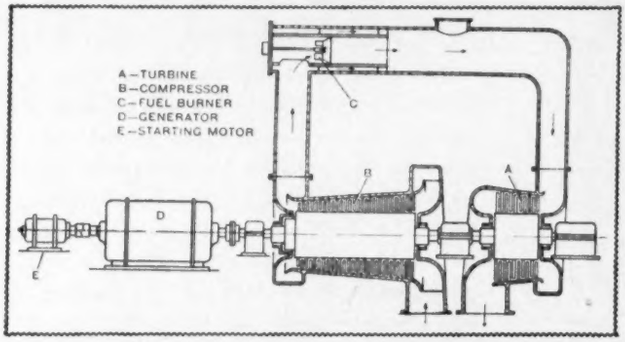
NEW IDEAS IN POWER AND ELECTRICAL EQUIPMENT ARE TAKING SHA

AVAILABLE UNDER HIGH PRIORITIES....ALL BELONG IN THE BAC

☛ Power plant of the future probably will be built around gas turbines... operating at efficiencies equal to or better than diesels but with the low maintenance and simple lubrication of steam turbines. Building space per unit output will be lowest of any prime mover and no water will be required.

Present signs: already 19 Allis-Chalmers gas turbines and compressor units are employed in refining high-octane gasoline.

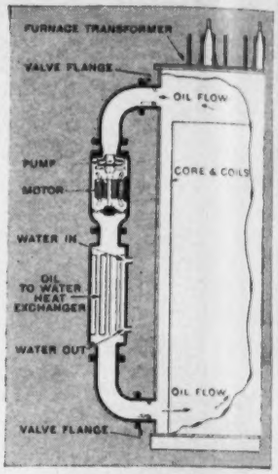
Operating sequence: 1) starting motor slowly rotates unit, building up air pressure, 2) fuel burner is ignited and hot gas enters turbine, 3) turbine takes load, drives compressor and generator, starting motor is disconnected.



OPERATING DIAGRAM OF MODERN COMBUSTION TURBINE

☛ Just moving oil faster in special transformer radiators — cools it enough so that designers need less copper and steel in transformer cores and coils. Allis-Chalmers "Electro-Cooler" does just that—but what's more it's done so simply that it makes forced oil cooling practical. That's the magic word—PRACTICAL!

So now that water-cooling coils are banned by WPB—and electric furnace transformers must be built without them—the "Electro-Cooler" with an oil-to-water heat exchanger replaces them. Allis-Chalmers transformer engineers save copper tubing—give steel makers a substitute for the water-cooled furnace transformer.



OIL-TO-WATER "ELECTRO-COOLER"

Investigate the widening applications of the "Electro-Cooler"—a unit composed of a heat exchanger and a "pump-in-a-pipe." Motor and pump are both immersed and lubricated by cooling oil.

☛ In the heart of a mercury arc rectifier, power-carrying electrons await the moment when a flash of bluish lightning will carry them from the anode to the cathode. There's one anode in each tank of a 6-tank Allis-Chalmers "Excitron" rectifier. Every 360th of a second, in sequence, bluish arcs flash in these tanks. What is the wizardry that times these arcs?

Excitrons are built to "fire when ready"—a procedure made possible by continuous excitation!

At the precise moment that a-c voltage on the anode equals the internal resistance of the mercury vapor gap—the bluish arc "train" leaves for the cathode.

ALLIS

t don't forget

SHAPE FAST AT ALLIS-CHALMERS TODAY. SOME ARE ALREADY BACK OF EVERY LONG-RANGE PLANNER'S HEAD. HERE ARE A FEW:

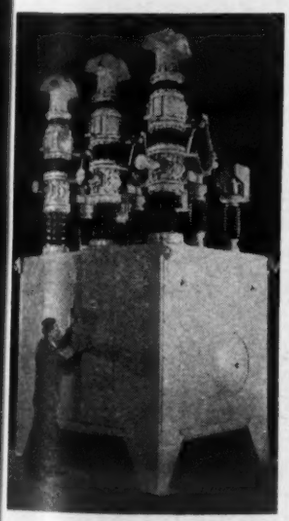
Six pilot arcs burning steadily do the trick—they're always ready to start the "trains" on the 360th of the second. Herein lies the simplicity and stability of the Allis-Chalmers "Excitron."

High priority wall surrounds "Excitron" today, prevents all but most essential uses.

But plan to use it postwar. Higher efficiency of "Excitron" suggests profitable replacement of thousands of motor generator sets and synchronous converters.

☛ Keep your eye on stronger trend toward air blast circuit breakers. Past year has seen Allis-Chalmers air-blast installations more than doubled.

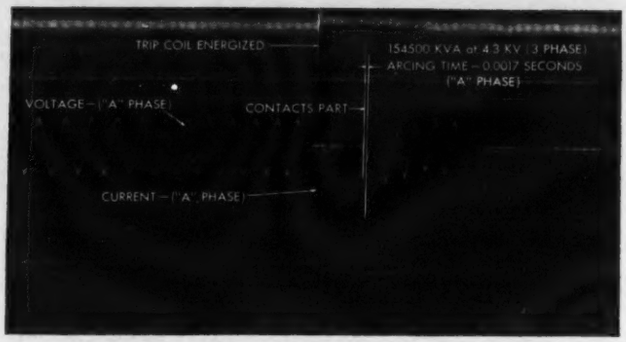
Think of air-blast breakers in terms of protection and maintenance savings. Arcing times, less than 1/2 cycle throughout operating range, mean amazing contact life.



1,000,000 KVA AIR BLAST

Here's how it works in brief: small contact piston pulls back from orifice, high pressure dry air rushing into hole. Arc rushes through, too . . . stretches out and vanishes—at split-cycle speed.

Reliability? Air brake systems of heavy trains are no safer.



OSCILLOGRAM OF AIR BLAST INTERRUPTION

☛ Biggest graphite "pencils" in the world write the flaming story of armor in the electric arc furnaces of Uncle Sam. Formerly these pencil-like electrodes were misguided by erratic up and down movements—calculated to keep pace with the melting charge. But at 3000 deg. F—overtravel and under-travel just burned them up and caused inefficient melting.

With a new sensitive, wide-range control generator called the "Regulex" exciter — Allis-Chalmers engineers are keeping furnace arcs constant, enabling extra "heats" per day, conserving graphite electrodes. Steel men are happy now!

Basic fact is that amplifying characteristics of "Regulex" exciter parallel in many respects those of the electronic tube—with the important exception that it has d-c machine life and ruggedness.

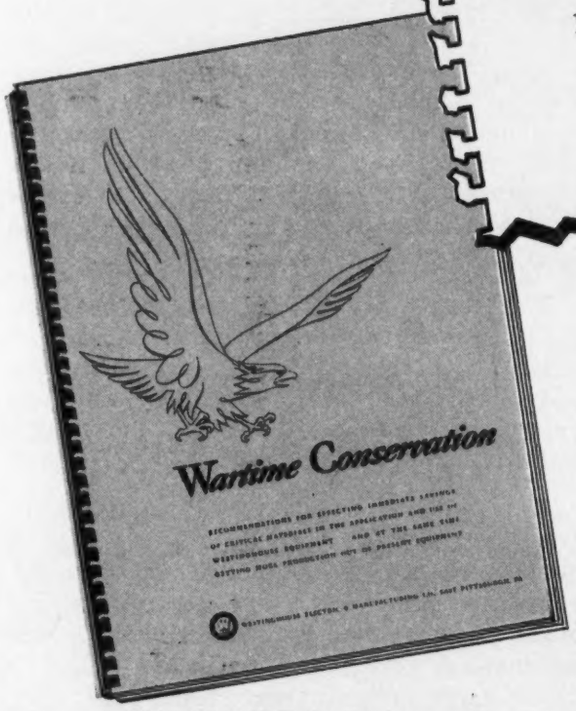
Look for other important new developments in electrical and power equipment from Allis-Chalmers. Maybe we can help you — maybe you can help us. ALLIS-CHALMERS, MILWAUKEE, WIS. A1612

CHALMERS

APPLY "Selective Service" TO YOUR TRANSFORMERS FOR WARTIME CONSERVATION

Recommendation: Present Transformers

4. Relocate transformers to secure maximum benefits of capacity and positive protection.



This book tells how to:

- **SAVE CRITICAL MATERIALS** in the selection, application and use of electrical equipment.
- **USE NEWLY DEVELOPED METHODS** to speed vital war production.
- **KEEP EQUIPMENT RUNNING** by proper Maintenance and Repair Service.
- **SAVE SCRAP** by systematic planning and salvage.

Selective Service puts available man power to work at the jobs for which it is best fitted.

The same principle can be used on transformers. They can be relocated to secure the maximum benefits of capacity and positive protection.

This can be accomplished by:

- Moving CSP (Westinghouse completely self-protecting) transformers to locations where lightning is most severe and load is subject to extreme fluctuations. These transformers cannot be damaged by lightning, short circuits, or overloads.
- Shifting conventional transformers to areas where lightning hazards are negligible, and load is comparatively steady.

By this and many other practical measures suggested in the Westinghouse Conservation Strategy, you can save Critical Materials. Write today for your free copy of this 100-page book, B-3206. Help conserve copper, steel, and other materials for direct war use. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N. J-90480

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Cool light means efficient light

• There is a reason why cool fluorescent light is the most efficient practical light known. It's simply because a fluorescent lamp transforms electrical energy into more light and with less heat than other light sources.

For fluorescent light production involves an electro-chemical process rather than a heat process. That is, ultraviolet radiation of a precise wave length causes the fluorescent powder coating inside the tube to emit light, rather than heat energy in the form of invisible infrared radiation.

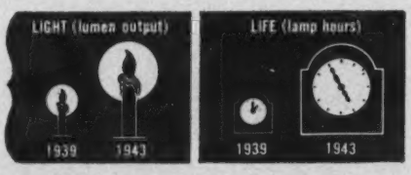
And there is a reason why Sylvania Fluorescent Lamps are as coolly efficient as modern research can make them. Sylvania engineers have drawn on years of specialized and basic experience with incandescent lamps, radio tubes, ultraviolet lamps and other electronic devices. Their aggressive and independent research has helped to make fluorescent a "must" for precision war production, and the best lighting for your home when Victory is won.

Sylvania's tireless research makes continued and consistent improvement possible. For more output, longer life and uniform color – specify Sylvania Fluorescent Lamps in authorized new installations and replacements.

SELL SYLVANIA AND GIVE YOUR CUSTOMERS FAR MORE LIGHT AND LIFE FOR THEIR MONEY

Compared with 1939 a dollar invested today in Sylvania Fluorescent Lamps buys more than four times the lumen output and approximately five times the lamp life.

SYLVANIA FLUORESCENT DOLLAR BUYS:



(Based on decreasing price and increasing efficiency and durability of Sylvania 40-Watt White Fluorescent Lamp)

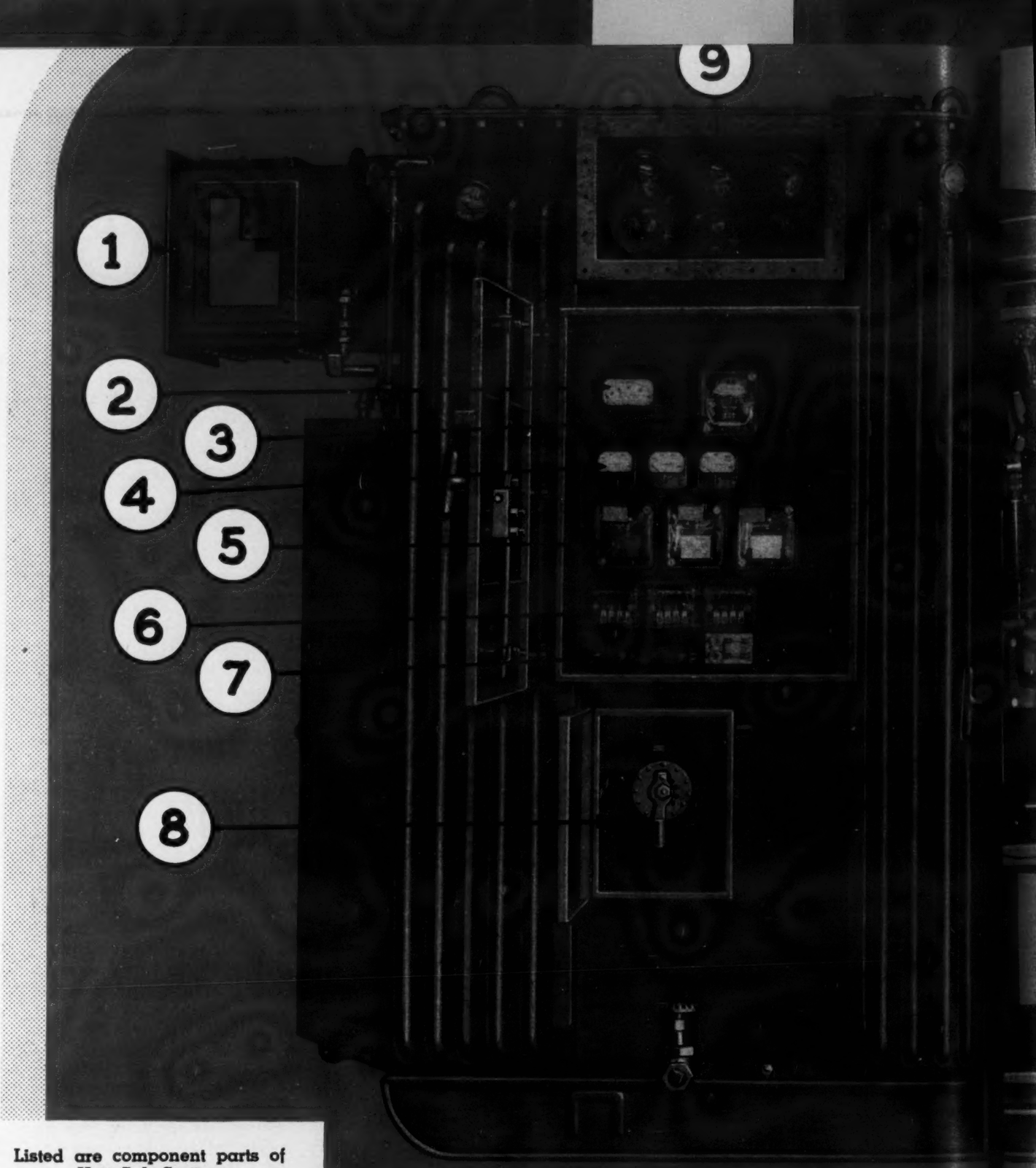
SYLVANIA

ELECTRIC PRODUCTS INC.

Formerly Hygrade Sylvania Corporation

Salem, Mass.

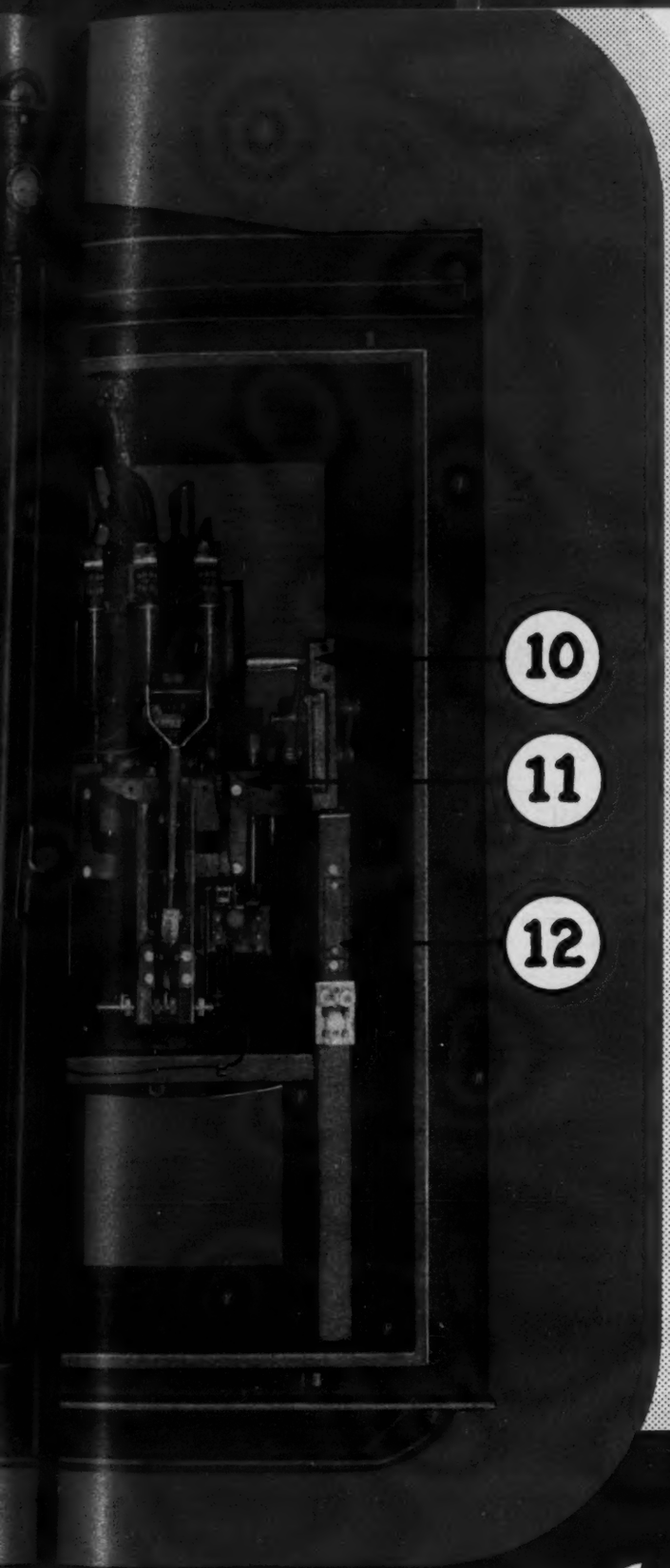
INCANDESCENT LAMPS, FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, RADIO TUBES, ELECTRONIC DEVICES.



Listed are component parts of Unit Sub Station

1. Secondary bus bar connections in junction box.
2. Voltmeter—secondary.
3. Watt-hour meter.
4. Ammeters—secondary.
5. Induction overcurrent relays.
6. Relay test switches.
7. Element heater for cabinet.
8. Tapchanger cabinet.
9. Mercoid temperature control switches.
10. Isolator operation handle.
11. Oil circuit breaker, 15 kilovolt., 600 amperes, electrically interlocked with isolator.
12. Element heater for cabinet.

TRADE MARK Standard



Here is a Unit Sub Station containing in a compact design all the essential equipment for complete power transformer service.

This 1000 KVA transformer, rated 11,500 volts primary, 460-Y secondary, 3 phase, 60 cycle, was shipped recently to one of our Navy Yards to handle the power distribution needs of that vital Naval Station.

Like all STANDARD Transformers, this unit was designed for a specific service—built by an experienced organization—constructed to withstand the severe service and long hours of operation required of a Naval Base in War time.

And looking ahead to the time when we get back to normal operation this STANDARD Transformer will still be in service meeting the less strenuous but equally important job of power distribution required to build up a stronger Navy than ever, for the protection of America.

STANDARD Transformer has both the engineering and manufacturing facilities to produce all types of transformers—they'll build the size, type and number required to meet your needs. For dependable, low cost power distribution consult a STANDARD Engineer on the type transformer best suited to your needs. Write or wire . . .

THE STANDARD TRANSFORMER CO.

WARREN • OHIO

10

11

12

Transformers

ENGINEERED AND BUILT
TO MEET YOUR SPECIFIC NEEDS

STARTS JUNE 1ST Another Series of

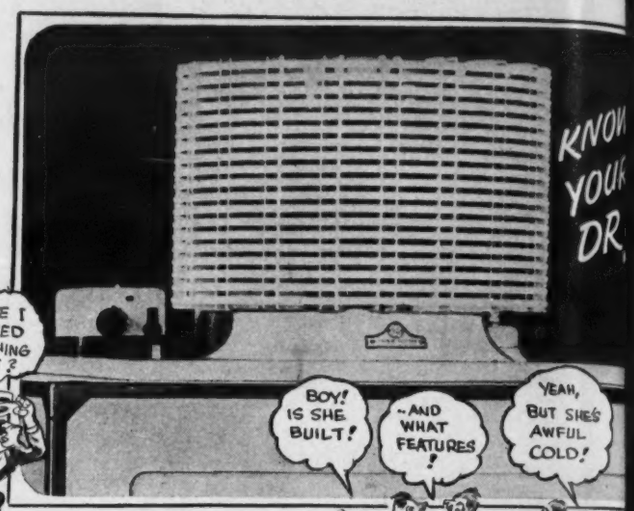
GENERAL ELECTRIC FIELD SCHOOLS featuring REFRIGERATION

PLUS A COMPLETE WARTIME SERVICE PROGRAM

THROUGH THESE PORTALS PASS THE WORLDS BEST INFORMED SERVICE MEN

STEP RIGH

A GREAT ARRAY TO YOUR WARTI



MOVIES! Finest professional talent! The DR machine in the stellar role. New, up-to-the-minute repair methods and techniques.

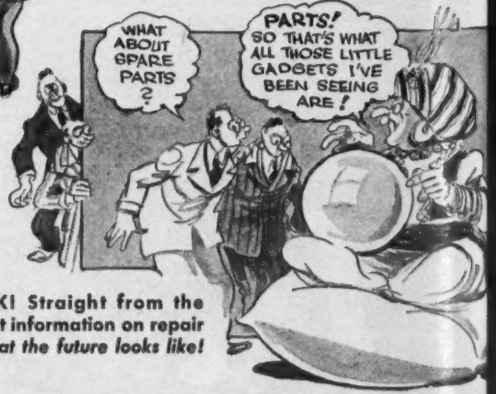
DON'T BLAME IT ON THE OVEN . . . A liberal education that cuts down complaints. Full color. Practical.

HOW TO TAKE CARE OF YOUR ELECTRIC APPLIANCES...A swell new handout booklet for the conservation-conscious customer.

HEADS OR TAILS . . . Shows you how to make SERVICE a real profit enterprise! Tailored right to your everyday needs.

"HOW TO REPAIR GENERAL ELECTRIC IRONS"

An *exclusive* new film. Talk about timing! Just when the need is greatest. Uncle Sam says, "Iron Repair Very Essential."

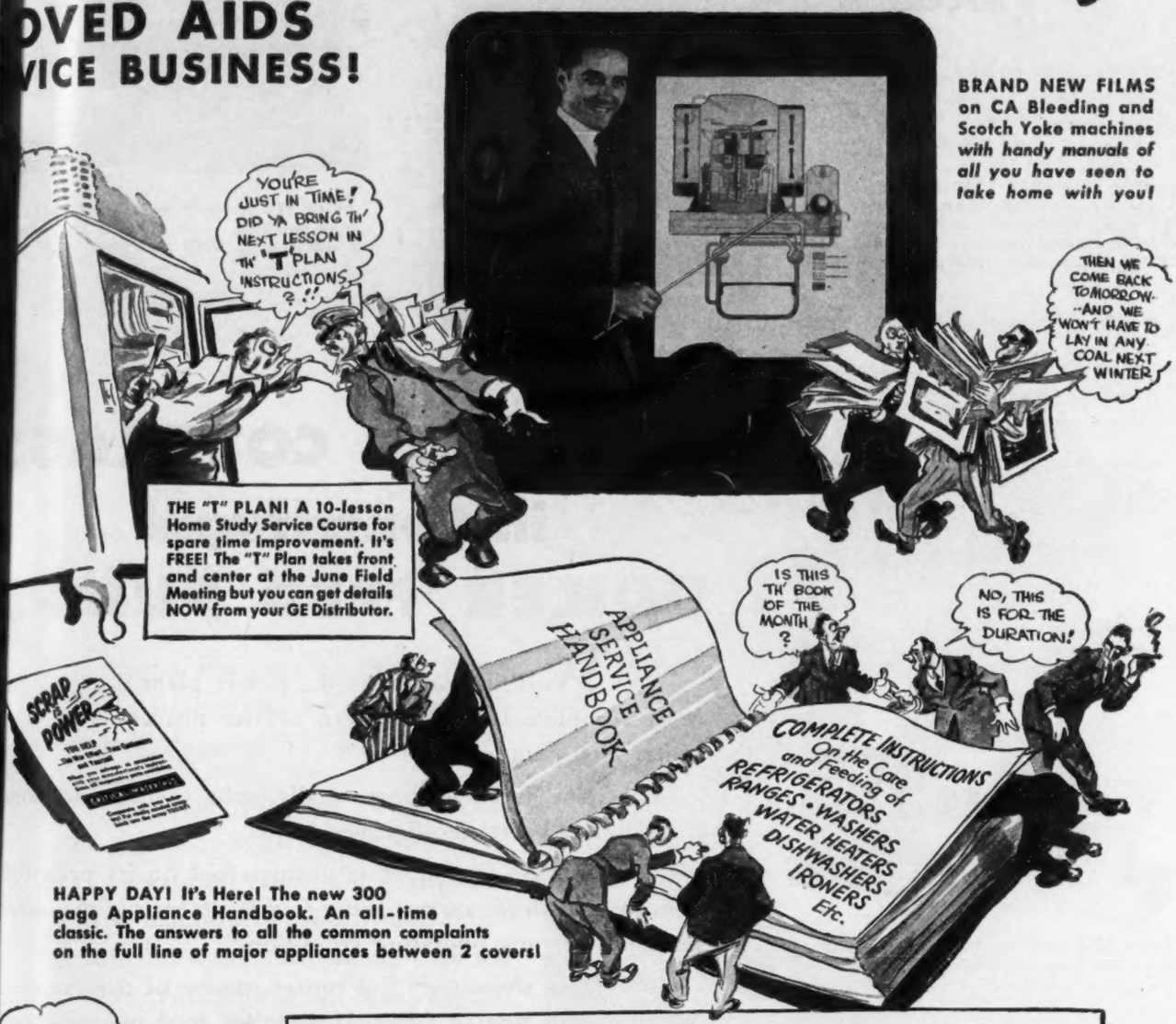


PARTS TALK! Straight from the crystal! Latest information on repair parts *and what the future looks like!*

WAR BONDS WILL BUILD AND EQUIP NEW VICTORY HO

...H AND TAKE A CHAIR!

...AY ...OVED AIDS ...RTI...VICE BUSINESS!


YOU'RE JUST IN TIME! DID YA BRING TH' NEXT LESSON IN TH' "T" PLAN INSTRUCTIONS ?!!
THEN WE COME BACK TOMORROW ..AND WE WON'T HAVE TO LAY IN ANY COAL NEXT WINTER

BRAND NEW FILMS on CA Bleeding and Scotch Yoke machines *with handy manuals of all you have seen to take home with you!*

THE "T" PLAN! A 10-lesson Home Study Service Course for spare time improvement. It's FREE! The "T" Plan takes front and center at the June Field Meeting but you can get details NOW from your GE Distributor.

IS THIS TH' BOOK OF THE MONTH ?
NO, THIS IS FOR THE DURATION!
APPLIANCE SERVICE HANDBOOK
COMPLETE INSTRUCTIONS On the Care and Feeding of REFRIGERATORS • RANGES • WASHERS WATER HEATERS DISHWASHERS IRONERS Etc.
SCRAP & POWER

HAPPY DAY! It's Here! The new 300 page Appliance Handbook. An all-time classic. The answers to all the common complaints on the full line of major appliances between 2 covers!

CHECK THIS LIST FOR THE NEXT G-E SERVICE TRAINING MEETING IN YOUR CITY
(If city near you is not listed, check your G-E Distributor)

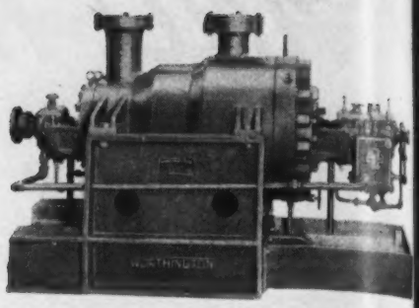
Allentown, Pa.	Fayetteville, N. C.	Massillon, Ohio	Rockford, Ill.
Altoona, Pa.	Findlay, Ohio	Maysville, Ky.	Saginaw, Mich.
Appleton, Wisc.	Flagstaff, Ariz.	Memphis, Tenn.	Salisbury, Md.
Ashland, Ky.	Fort Wayne, Ind.	Middlesboro, Ky.	San Bernardino, Cal.
Ashland, Ohio	Grand Rapids, Mich.	Milwaukee, Wisc.	Santa Barbara, Cal.
Atlanta, Ga.	Hagerstown, Md.	Minneapolis, Minn.	San Diego, Cal.
Atlantic City, N. J.	Harrington, Del.	Morganton, N. C.	Scranton, Pa.
Binghamton, N. Y.	Harrisburg, Pa.	Muncie, Ind.	Sioux City, Iowa
Bluefield, W. Va.	Indianapolis, Ind.	Nashville, Tenn.	Sioux Falls, S. Dak.
Cape Girardeau, Mo.	Jefferson City, Mo.	Omaha, Neb.	South Bend, Ind.
Charleston, W. Va.	Joplin, Mo.	Oxford, Ohio	Springfield, Ill.
Chattanooga, Tenn.	Kansas City, Mo.	Paducah, Ky.	St. Louis, Mo.
Chicago, Ill.	Knoxville, Tenn.	Peoria, Ill.	St. Paul, Minn.
Columbus, Ohio	La Crosse, Wisc.	Philadelphia, Pa.	Syracuse, N. Y.
Davenport, Iowa	Lancaster, Pa.	Phoenix Ariz.	Tampa, Fla.
Dayton, Ohio	Lawrenceburg, Ind.	Pittsburgh, Pa.	Terre Haute, Ind.
Denver, Colo.	Lexington, Ky.	Pueblo, Colo.	Toledo, Ohio
Des Moines, Iowa	Long Island City, N. Y.	Queensboro, N. C.	Tucson, Ariz.
Dubuque, Iowa	Los Angeles, Cal.	Quincy, Ill.	Waterloo, Iowa
Duluth, Minn.	Louisville, Ky.	Raleigh, N. C.	West Orange, N. J.
Evansville, Ind.	Madison, Wisc.	Reading, Pa.	Wichita, Kan.
Fargo, N. Dak.	Mason City, Iowa	Rochester, N. Y.	Wilmington, Del.

Ask your General Electric Appliance Distributor for Meeting Dates and Reservation for Yourself and Service Staff.

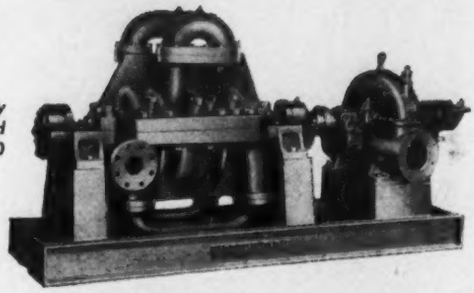
GENERAL ELECTRIC

...RROW!

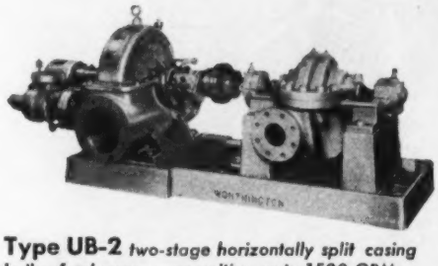
WORTHINGTON



Type WC *Multistage solid forged steel barrel boiler feed pump—capacities up to 3000 GPM—pressures up to 3000 p.s.i.*



Type UX *Multistage large horizontally split casing, axially and radially balanced boiler feed pump—capacities up to 1500 GPM—pressures up to 1250 p.s.i.*



Type UB-2 *two-stage horizontally split casing boiler feed pump—capacities up to 1500 GPM—pressures up to 450 p.s.i.*

COMPLETE COVERAGE in Centrifugal BOILER FEED PUMPS

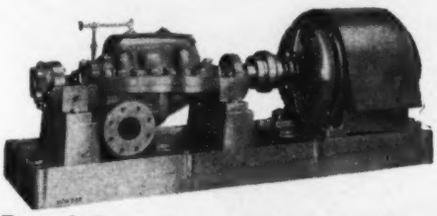
Worthington offers the power plant designer the most complete line of modern service-proven centrifugal boiler feed pumps.

This line includes horizontally split casing and solid forged steel barrel multistage pumps.

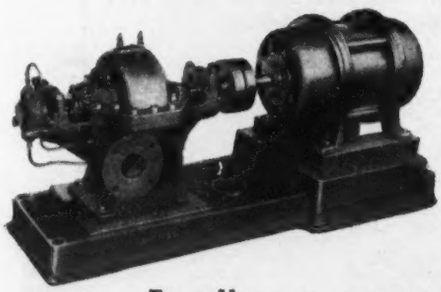
Worthington's position is unsurpassed on its preparedness to furnish *the correct boiler feed pump built of the correct materials* for any operating condition.

The types shown are but representative of the extensive Worthington line of centrifugal boiler feed pumps—many others are available.

Electric Motor or Steam Turbine Drive

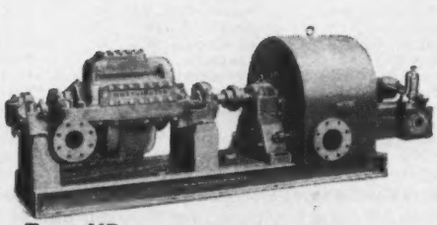


Type UQ *four-stage horizontally split casing boiler feed pump—capacities up to 1500 GPM—pressures up to 650 p.s.i.*

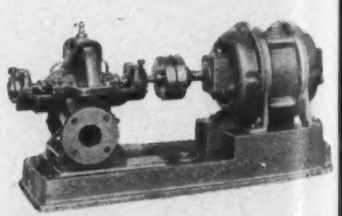


Type U *two-stage horizontally split casing boiler feed pump—capacities up to 300 GPM—pressures up to 250 p.s.i.*

Both the Navy E and Army-Navy E Awards have been presented to Worthington for speed and excellence in production.



Type UR *six-stage horizontally split casing boiler feed pump—capacities up to 750 GPM—pressures up to 800 p.s.i.*

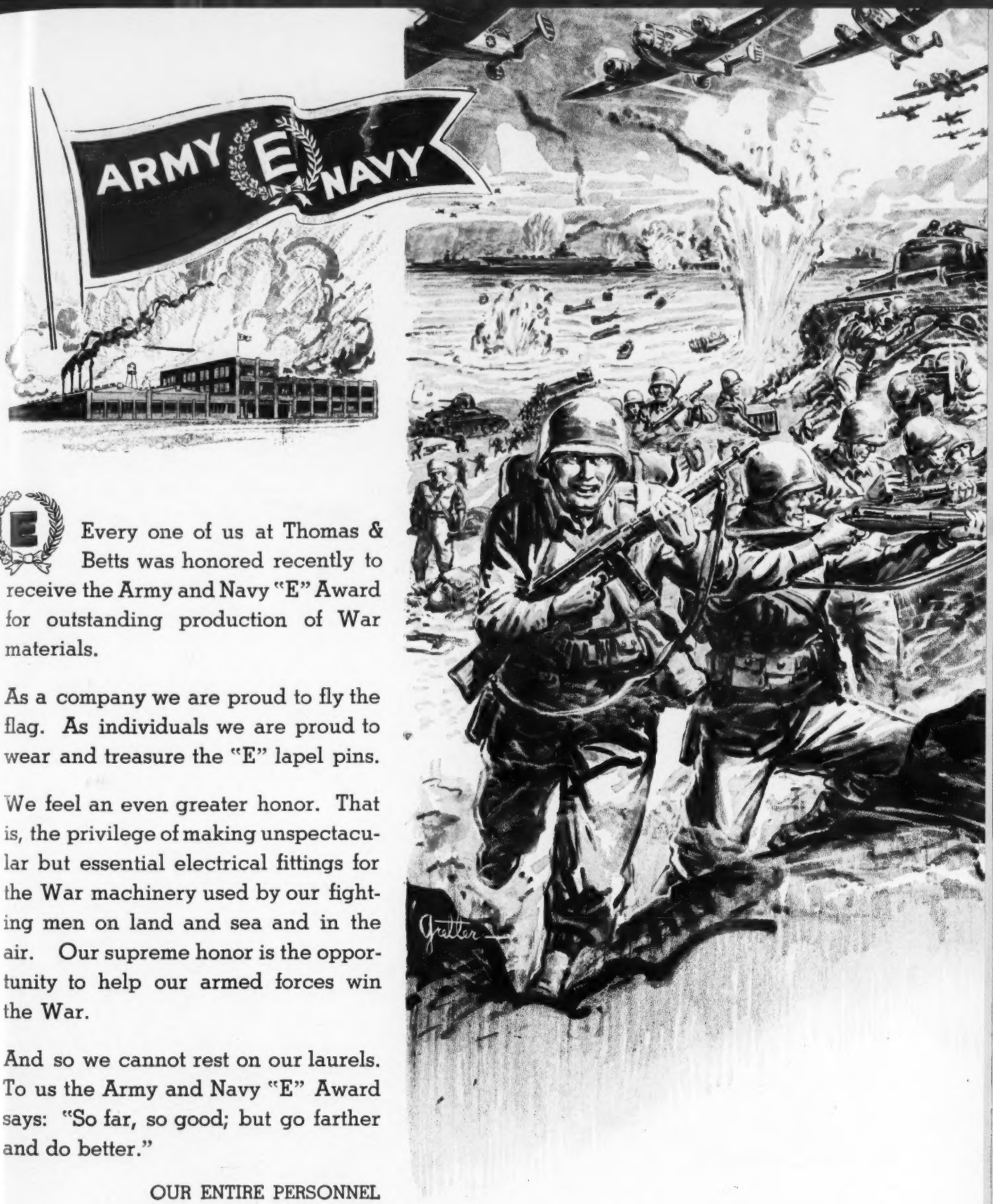


Type R *single-stage horizontally split casing boiler feed pump—capacities up to 400 GPM—pressures up to 200 p.s.i.*

MEMBER

CP3-6

WORTHINGTON PUMP AND MACHINERY CORPORATION · HARRISON, NEW JERSEY



Every one of us at Thomas & Betts was honored recently to receive the Army and Navy "E" Award for outstanding production of War materials.

As a company we are proud to fly the flag. As individuals we are proud to wear and treasure the "E" lapel pins.

We feel an even greater honor. That is, the privilege of making unspectacular but essential electrical fittings for the War machinery used by our fighting men on land and sea and in the air. Our supreme honor is the opportunity to help our armed forces win the War.

And so we cannot rest on our laurels. To us the Army and Navy "E" Award says: "So far, so good; but go farther and do better."

OUR ENTIRE PERSONNEL

T&B

THE THOMAS & BETTS CO.

INCORPORATED

MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

ELIZABETH, NEW JERSEY

In Canada: Thomas & Betts Ltd. Montreal

You Get Uniformity In
ILLINOIS PORCELAIN BUSHINGS

Control of production methods assures uniformity of ILLINOIS Porcelain. Internal stress is eliminated—exact dimensions are assured—accurate kiln firing prevents strains. You get uniformity of color regardless of size of order. Perfect alignment of porcelain hole and mounting base. Your ILLINOIS Porcelain Bushings accurately line up in the transformer case.

HIGH DIELECTRIC STRENGTH

•

HIGH MECHANICAL STRENGTH

•

EXACT DIMENSIONS AND UNIFORMITY

•

ILLINOIS
ELECTRIC PORCELAIN CO., MACOMB, ILL.

DO THINGS BETTER, FASTER, MORE ACCURATELY—*THE ELECTRONIC WAY*

TYPICAL ELECTRONIC JOBS DONE BY RCA TUBES

Communicating • Heating • Dehydrating
Measuring • Checking • Analyzing • Actuating
Protecting • Testing • Detecting • Matching
Controlling • Guiding • Sorting • Magnifying
Rectifying • Counting • Transforming
"Seeing" • "Feeling"

INDUCTION HEATING

...the electronic answer to many industrial problems

High on the list of Electronic developments that have seen tremendous expansion under impetus of war requirements is Induction Heating.

This Electronic method has meant important savings in time and cost on jobs ranging from case hardening, annealing, riveting, and tin-plating, to food dehydration, plywood glueing and others. It has meant better heat control and greater uniformity. It has meant simplified handling of materials to be treated—and much more.

Here, as in other phases of Electronic development, the radio tube is the "magic brain" of the process —and the fountainhead of modern tube development and production is RCA.

Made in varied lines for almost any Electronic application, RCA tubes afford a broad engineering selection of types, each with a background of proved performance that assures long life, utmost dependability, and high efficiency.

In the Electronics of the future, as in the Radio of today, RCA Tube engineering will continue to lead the way—*all the way!*

RADIO CORPORATION OF AMERICA

RCA Victor Division, Camden, N. J.

RCA TUBE PUBLICATIONS

Following are a few of the Tube publications available from RCA Commercial Engineering Section, 416 South Fifth St., Harrison, N. J.:

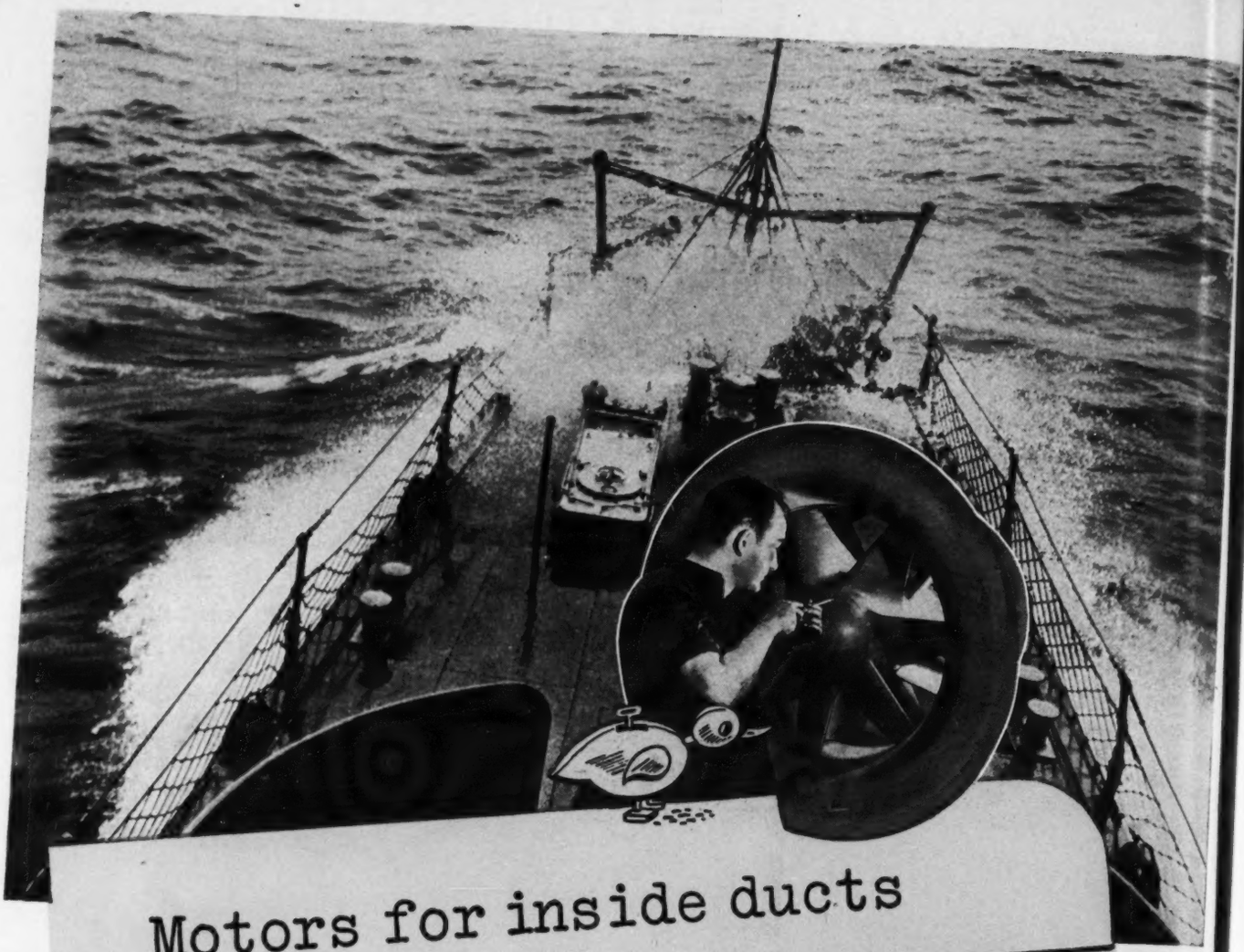
RCA TRANSMITTING (Power) TUBE GUIDE... 72 pages of data and circuits for popular RCA Power Tubes, U-H-F Acorn and Midget types, Gas-triodes, and Gas-tetrodes. Single copy, 35c.

TT-100 TRANSMITTING AND SPECIAL-PURPOSE TUBES BULLETIN... Illustrated catalogue information on RCA air- and water-cooled transmitting tubes, rectifiers, television tubes, voltage regulators, and special amplifiers. Single copy, no charge.

RCA PHOTOTUBE BOOKLET... Provides a clear understanding of theory, construction, and operation. Single copy, no charge.

RCA RADIO-ELECTRONIC TUBES

High-vacuum, gas, and vapor tubes • Voltage amplifiers • Low-power and medium-power tubes • Cathode-ray tubes • Rectifiers • Voltage regulators • Relay tubes



Motors for inside ducts

IT'S WEATHER FOR EMERGENCY LIFE-LINES ON DECK THIS DESTROYER...BUT BELOW, CREW AND OFFICERS WORK IN COMFORT. SPECIALLY DESIGNED WESTINGHOUSE BLOWER MOTORS IN DECK DUCTS SUCK IN SEA AIR....CIRCULATE IT THROUGH A MAZE OF DUCTS FOR SHIP VENTILATION.

THESE COMPACT MOTORS AND FANS, BUILT AS AN INTEGRAL UNIT, FIT INSIDE DECK DUCTS. STURTEVANT DESIGNED THE VENTILATOR; WESTINGHOUSE — THE MOTOR. EACH UNIT MUST WITHSTAND THE GUN SHOCK AND POUNDING OF A SEA AND AIR BATTLE. IN ADDITION TO SAVING VALUABLE DECK SPACE, THIS SPECIAL MOTOR INCREASES VENTILATING EFFICIENCY MORE THAN 15% AND REDUCES NOISE LEVEL BY 25%.

SIMILARLY, MANY OTHER MOTOR AND CONTROL APPLICATIONS IN WAR INDUSTRIES REQUIRE SPECIALIZED ENGINEERING...CO-ORDINATION FOR FINISHED UNIT BETWEEN A WESTINGHOUSE PRODUCT AND YOURS.

USE OUR FACILITIES. ABOVE ALL, TAKE ADVANTAGE OF OUR MOTOR AND CONTROL APPLICATION EXPERIENCE. PHONE YOUR NEAREST WESTINGHOUSE OFFICE FOR IMMEDIATE HELP. OR WRITE WESTINGHOUSE ELECTRIC & MANUFACTURING CO. — DEPT. 7-N — E. PITTSBURGH, PA.

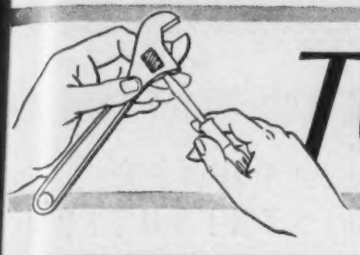
J-21278

WESTINGHOUSE

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

MOTORS AND CONTROL



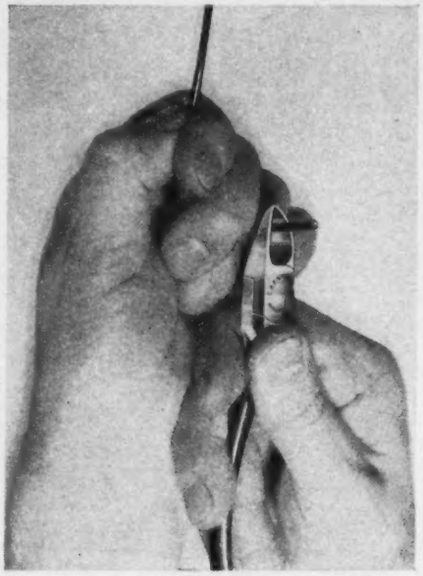
TOOL NOTES

"How To Do It" Information For Crescent Tool Users

No. 10 HOW TO USE LIGHT PLIERS FOR TELEPHONE, RADIO AND SIGNAL WORK

● There is a definite technique employed by experienced mechanics, in working with light insulated wire, that is both time-saving and workmanlike. The operations of cutting, "skinning" and "cleaning" occur very frequently in practically all work of this general type. In the procedure described below, Crescent's Light Diagonal Plier No. 942 performs these operations equally well with both solid and stranded conductor wire.

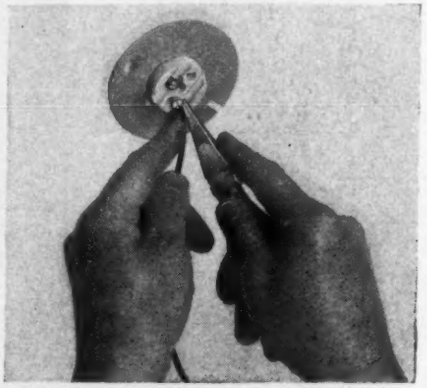
Here is the proper way to grasp a light diagonal plier. The little finger "inside" the handles provides a counter pressure to hold the jaws apart. Pressure of the thumb stabilizes the tool and helps maintain desired jaw opening. Some mechanics include the third finger with the little finger "inside" the handles, using index and second finger for "outside" pressure.



To "skin" wire, grasp it as shown with the left hand. Now with plier held as above described, close the jaws sufficiently to cut thru the insulation *only*. Don't cut thru the conductor! Counter pressure of "inside" fingers and steadying action of thumb pressure provide excellent control over depth of cut. Now, with both hands as illustrated, "rock" plier handles toward left wrist and the resultant prying action will strip the insulation from the wire end.

MAIL THE COUPON
for free reprints of this series of 10 informative ads. Indicate whether wanted for bulletin board use or punched for 3-ring binder.

"Cleaning" or brightening of the bare wire is accomplished as illustrated here. Close jaws just enough to provide slight pressure and draw cutter blades along the bare wire a few times. Rotate wire with fingers and thumb of the left hand so that the entire circumference is cleaned.



When making connections with light wire in inaccessible places, Crescent's Long Nose Pliers No. 1033 or 654 are very useful. Grasp end of wire with plier tip, and with left hand holding wire as shown, wrap the bare end around terminal screw.

CRESCENT TOOLS
Give Wings to Work

CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

Crescent Tool Co., Jamestown, N. Y. A-4
Please send your "TOOL NOTES" Series
☐ for Bulletins ☐ for 3-ring binder

Name _____

Address _____

City _____ *State* _____

Synonymous with Quality!

Wagner

TRANSFORMERS

reflect sound engineering and modern manufacturing methods . . .

★ ★ ★

POWER
DISTRIBUTION
AIR-COOLED
NOFLAMOL*
***(NON-INFLAMMABLE LIQUID FILLED)**

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

WAGNER BRANCH OFFICES

ATLANTA
BALTIMORE
BOSTON
BUFFALO
CHICAGO
CINCINNATI
CLEVELAND
DALLAS
DENVER
DETROIT
HOUSTON
INDIANAPOLIS
KANSAS CITY
LOS ANGELES
MEMPHIS
MILWAUKEE
MINNEAPOLIS
NEW YORK
OMAHA
PHILADELPHIA
PITTSBURGH
PORTLAND
ST. LOUIS
SALT LAKE CITY
SAN FRANCISCO
SEATTLE
SYRACUSE
TULSA
WASHINGTON, D.C.

In army camps, ordnance and power plants, in the oil fields, and throughout the chemical and steel industries, Wagner transformers daily demonstrate their excellence in quality. From the very beginning, the name Wagner has been *synonymous with quality.*

If you are in need of transformers to complete your war production schedules, consult the nearest of Wagner's 29 branch offices, located in principal cities and manned by trained field engineers.

Write
FOR BULLETINS
TU-33 (NOFLAMOL)
TU-181 (POWER)
TU-180 (DISTRIBUTION)

143-4

★ ★ ★

Wagner Electric Corporation
ESTABLISHED 1891
6456 Plymouth Avenue, St. Louis, Mo., U. S. A.
ELECTRICAL AND AUTOMOTIVE PRODUCTS

Are you showing your men how to fight fire?

• Against fire, "know-how" is a mighty weapon. Men who know how each extinguisher should be used, who know when it should *not* be used, men who know that a fire in electrical wiring must not be handled with the same fire-fighter you would use for a rubbish blaze . . . these men can save your plant in a quick-striking emergency.

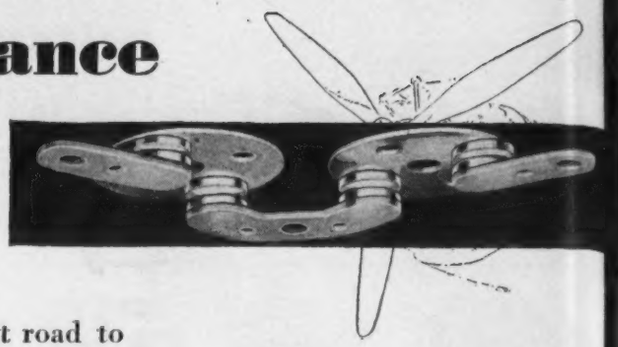
It's up to you to train these men. You will train them best by letting them see extinguishers in action against real fires. *You will stage demonstrations at your plant.*

Walter Kidde & Company will send you a booklet which tells how to make demonstrations dramatic and instructive . . . how to teach men to know their fire-fighters. Write to

Walter Kidde & Company, Inc.
525 Main Street **Belleville, N. J.**

Kidde
HIGH PRESSURE GASES · FIRE PROTECTION
PROTECTS LIVES

The Shortest Road to Contact Performance



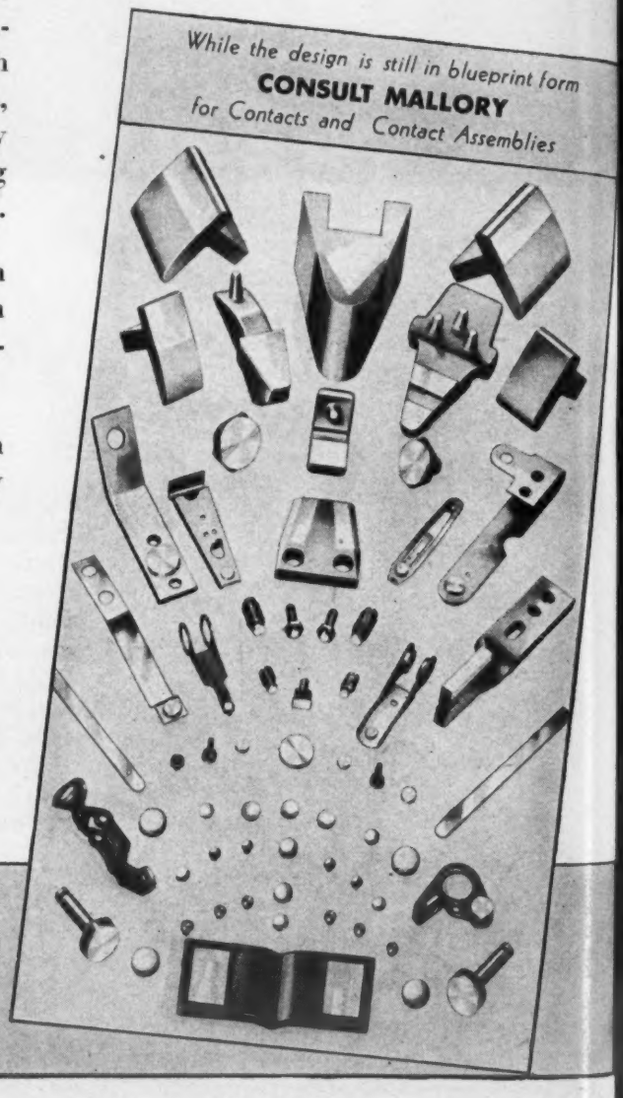
Consultation in the blueprint stage is the shortest road to contact performance. Mallory experience and "know how" will prevent most of the "bugs" inherent in theoretical design—and get at the root of unforeseen difficulties in lightning order.

A case in point is that of the aircraft relay for the control of "pitch change" motors for plane propellers. The propeller manufacturer required a small light relay capable of handling currents up to 150 amperes—and he had to have prompt action.

Mallory engineers tackled the problem; re-worked a standard 50-ampere double-break relay, incorporating Mallory Elkonite contacts in the design for a complete contact assembly. The toughest kind of life tests were conducted, embracing rapid, continuous operation with overloads in excess of 150 amperes. During the tests, contact members heated to a dull red. But Mallory Elkonite stood the gaff—and now is providing dependable operation for a highly specialized relay.

In this case, speed of development, combined with perfect contact functioning, is worth noting. When experience and "know how" concentrate on cooperation, contact difficulties vanish swiftly.

You'll find eager cooperation awaiting you when you bring contact or complete contact assembly problems to Mallory.



P. R. MALLORY & CO., Inc.
INDIANAPOLIS, INDIANA
Cable Address—PELMALLO

Elkonite—Reg. U. S. Pat. Off.

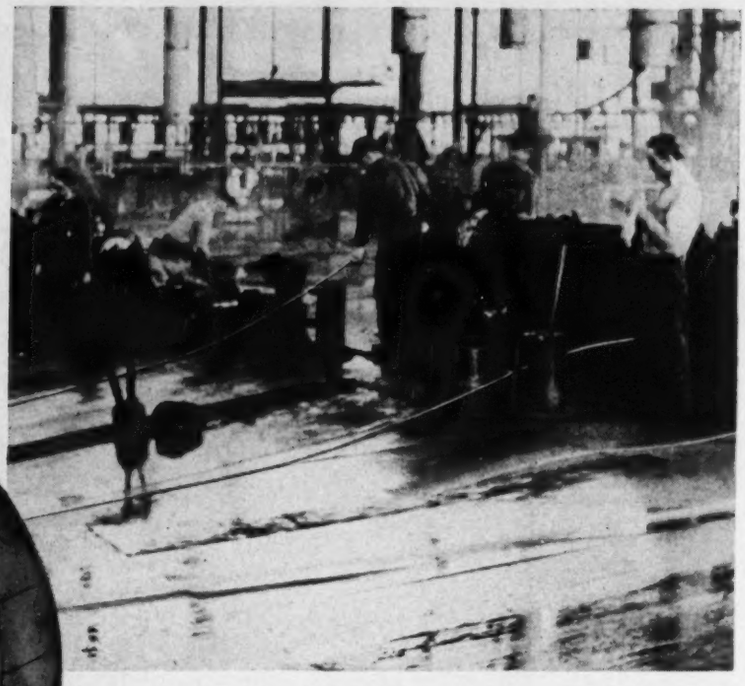
P. R. MALLORY & CO. Inc.
MALLORY

ELECTRICAL CONTACTS AND CONTACT ASSEMBLIES . . . NON FERROUS ALLOYS
POWDERED METAL ALLOYS

Every Stage in Wire-Making

is Controlled by

ROME CABLE



Maintaining our own rolling mills, we start fabrication with the copper bar.

All Rome Cable products are manufactured in our own mills to exacting standards under strict engineering supervision. Every process is carefully controlled and no finished products are released without the approval of our Inspection Department.

REASONS FOR ROME CABLE QUALITY

PRODUCTS

HOT ROLLED COPPER RODS

BARE AND TINNED COPPER WIRE
(in rounds, flats and squares)

BARE AND TINNED STRAND

URC WEATHERPROOF WIRE

COTTON, PAPER AND ASBESTOS MAGNET WIRE
(in rounds, flats and squares)

RUBBER INSULATED WIRES AND CORDS

SYNTHETIC INSULATED WIRES AND CABLES
(Thermoplastic—Neoprene)

LEAD COVERED CABLES

SERVICE ENTRANCE CABLES

★ ★ ★

"Rome 60" Heavy Duty Cords and Cables

ROME
CABLE CORPORATION
ROME, N. Y.

SALES OFFICES

NEW YORK
60 E. 42nd. St.

CHICAGO
208 S. Jefferson St.

LOS ANGELES
327 E. 4th. St.

PITTSBURGH
2537 Koppers Bldg.

CLEVELAND
817 Citizens Bldg.

PHILADELPHIA
1803 Liberty Trust Bldg.

MARSHFIELD HILLS, MASS.

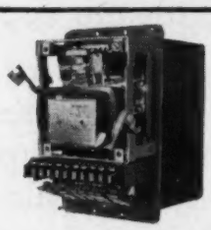
RICHMOND, VA.
2027 South Blvd.

WASHINGTON, D. C.
Room 410, Bond Bldg.

"Unitized" Switchgear puts

TWO IN ONE

with the *Flexitest* Relay Case



Chassis partly removed from case

CHECK THESE FEATURES

1. Test switches mounted at front of relay.
2. Test plug, or just spring clips, may be used for testing.
3. Slot on switch handle for circuit identification.
4. Chassis cannot be removed without latch opening the red trip circuit switch.
5. Removable chassis.
6. Cam-action latches.
7. Optional cover interlock for automatically opening trip circuit as cover is removed.
8. Permanently mounted case.
9. Holes in switch handles for interlocking bars.

These are just a few of the many reasons why your next switchboards should have Flexitest Relays.

The FLEXITEST "two-in-one" case combines in one compact design any Westinghouse protective relay with KNIFE-BLADE TEST SWITCHES. It brings maximum flexibility of maintenance and testing to "Unitized" Switchgear.

Panel space is conserved . . . wiring of a separate test switch is eliminated . . . and manufacturing time is saved.

Appearance matches "Unitized" design. Mounting hardware is concealed. Nothing protrudes beyond the front of the relay . . . not even the captive nuts which fasten the cover.

The FLEXITEST design will fit any testing procedure regardless of the kind of test equipment used. Never before has such a high degree of flexibility, reliability, and visibility been combined to make routine testing quick and easy.

For detailed information, ask for Bulletin 3217. Address Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Department 7-N.

J-40338

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

"UNITIZED" SWITCHGEAR

OLIVER

OLIVER PINS

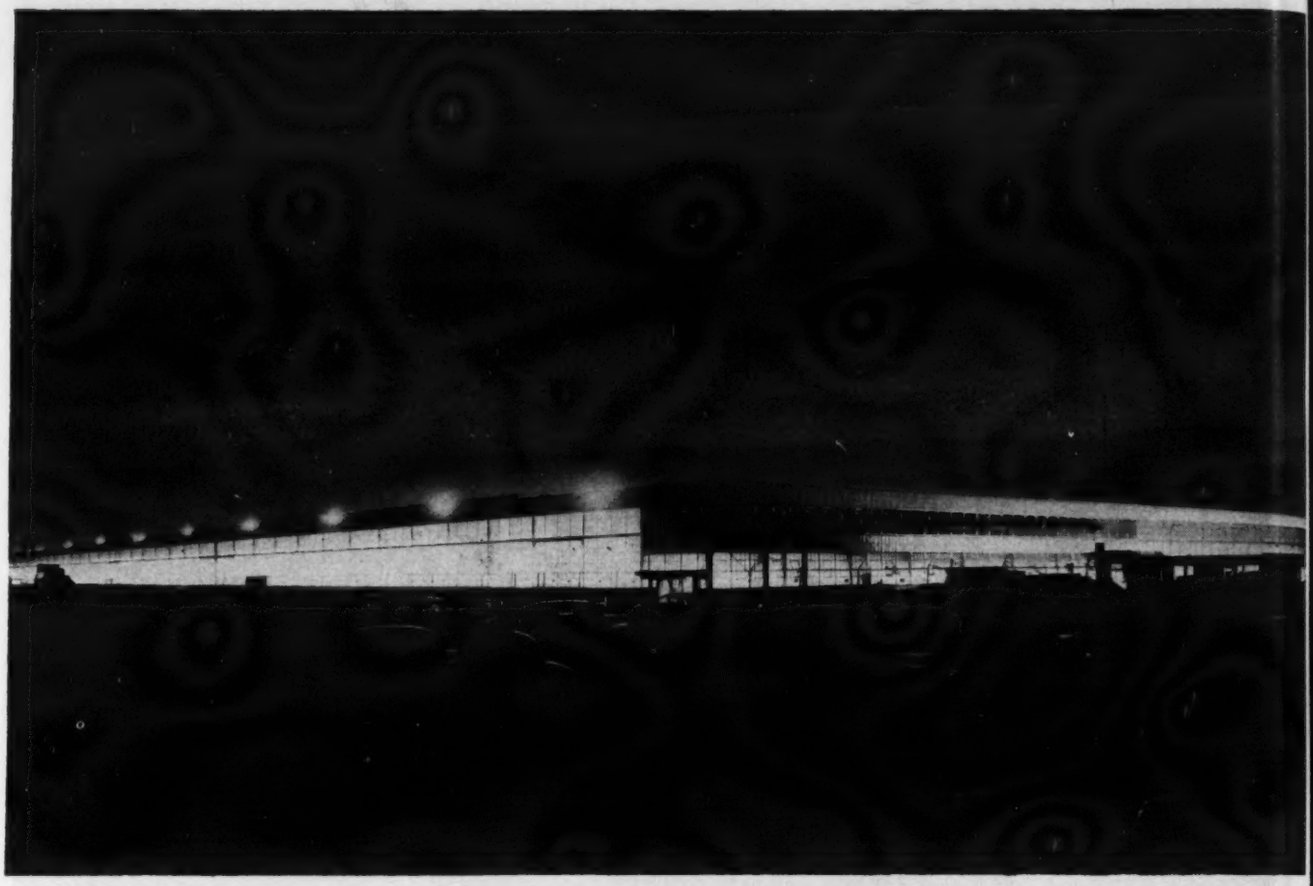
sizes and types for every application

Oliver Insulator Pins are made in well over a hundred styles, sizes and types for screw, clamp or bolt fastening; for wood and steel crossarms, steel transposition brackets and break arms, for poles, pole tops, etc.

They are made from mild open-hearth steel, hot dip galvanized. Various types of Oliver Insulator Pins are fitted with different kinds of threads: steel, malleable iron, lead, zinc. Special Oliver construction assures a perfect bond between pin and thread. Cobs are made from seasoned wood, thoroughly impregnated with paraffin. Write for complete information.

OLIVER
IRON AND STEEL
Corporation
Makers of Pole Line Materials Since 1894
PITTSBURGH, PENNSYLVANIA

POWER IN WAR WORK!



TWENTY-FOUR hours a day, war plants like this one . . . turning out planes, tanks, guns, shells and countless other sinews of war . . . are bright, busy examples of the vital part now being played by electrically-generated *power.*

As an aid in meeting the Nation's all-time high demand, public utilities in all parts of the country are assuring maximum power output from their steam turbines by lubricating them with *Texaco Regal Oils.*

Texaco Regal Oils for steam turbines rapidly free themselves from air and water, and are highly resistant to oxidation and emulsification. They keep lubricating systems free from harmful gum and sludge deposits, assuring normal bearing temperatures . . . and governors instantly responsive to every load-change.

So effective have Texaco Lubricants proved that they are definitely preferred in many other important fields, a few of which are listed in the panel.

A Texaco Lubrication Engineer will gladly cooperate in the selection of the most suitable lubricants for your equipment. Just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated and fueled with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

TEXACO

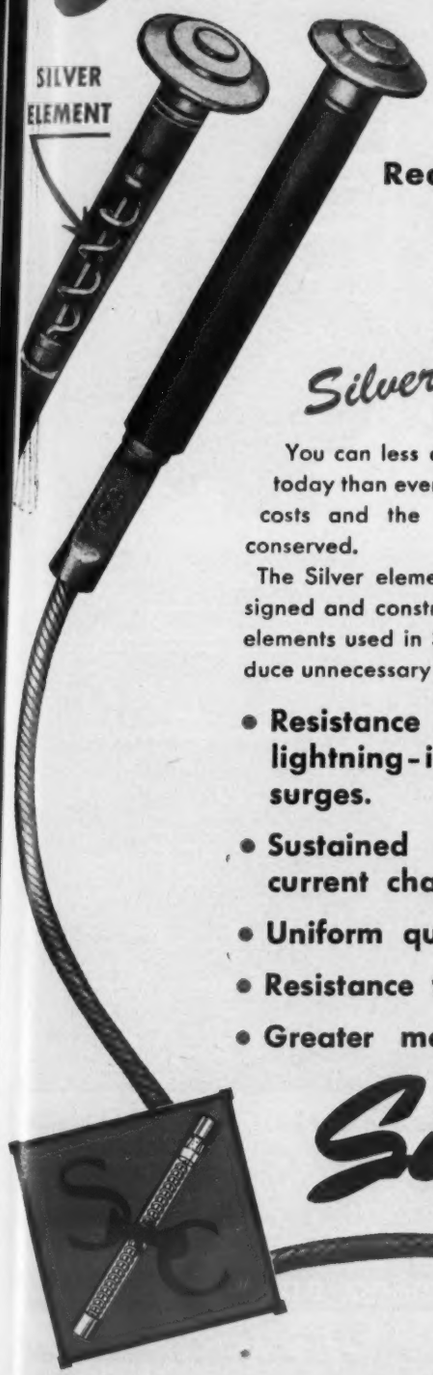
REG. T.M.

TEXACO Lubricants

FOR ALL TURBINES

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

CHECK LIGHTNING SABOTAGE



Reduce Unnecessary Outages with

Silver FUSE LINKS

You can less afford unnecessary outages today than ever before. Man-hours, service costs and the links themselves must be conserved.

The Silver elements of S & C Links are designed and constructed like the time-proven elements used in S&C Power Fuses. They reduce unnecessary outages because of their—

- **Resistance to damage due to lightning-induced and other surges.**
- **Sustained accuracy of time-current characteristics.**
- **Uniform quality.**
- **Resistance to corrosion.**
- **Greater mechanical strength.**

Install S & C Links now to *prevent* unnecessary extra re-fusing work and the waste of man-power and truck miles. Deliveries made from stock in most fuse link capacities.

SCHWEITZER & CONRAD, INC.
4435 Ravenswood Avenue, Chicago, Ill.
Manufactured in Canada by Powerlite Devices, Ltd., Toronto, Ontario

Silver FUSE LINKS

Here's complete data on a new G & W development

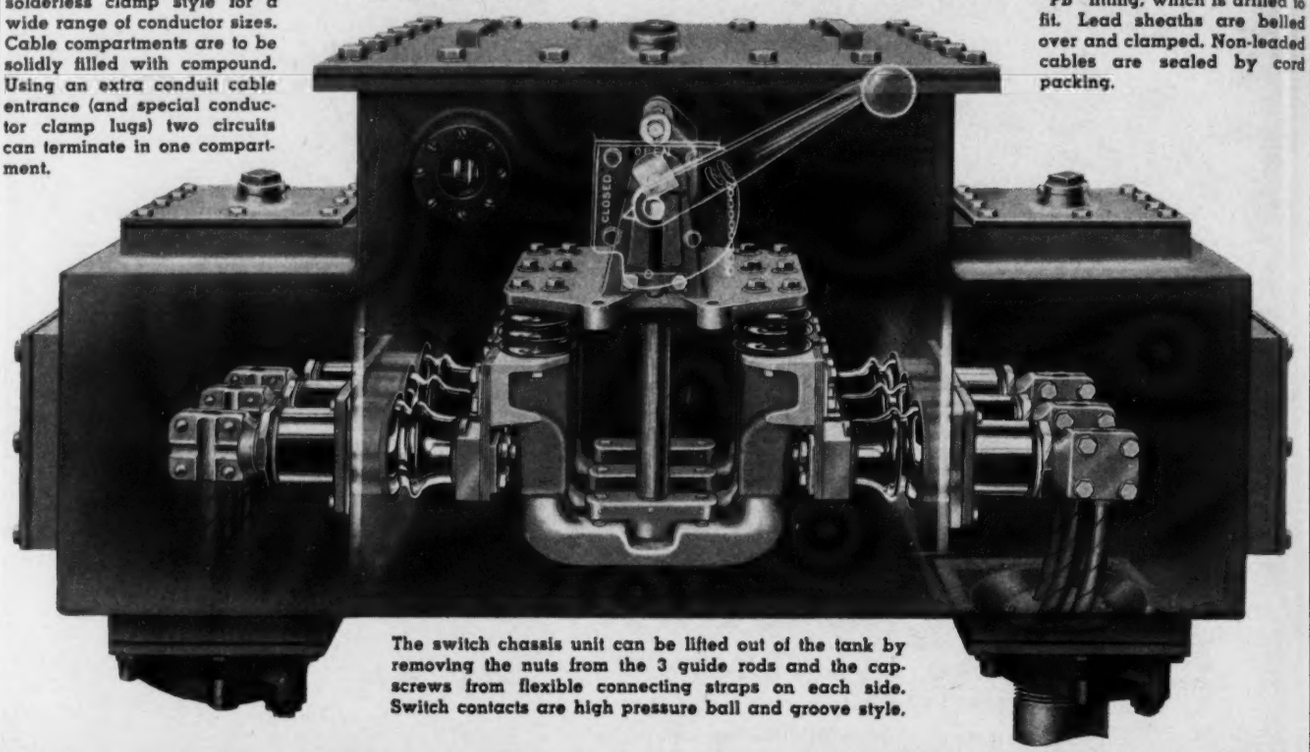
G&W TYPE "DIPK" OIL SWITCH—3 POLE-5000 VOLTS-600 AMP.

G & W Type "DIPK" oil switches were specially designed for use in oil refineries and chemical plants to meet the requirements of equipment for hazardous locations. The live parts within the oil switch are 6 inches below the level of the oil. The tank is one piece heavy welded steel construction. *The conduit cable connections on each side can be interchangeably brought in vertically, from above or below, or horizontally.*

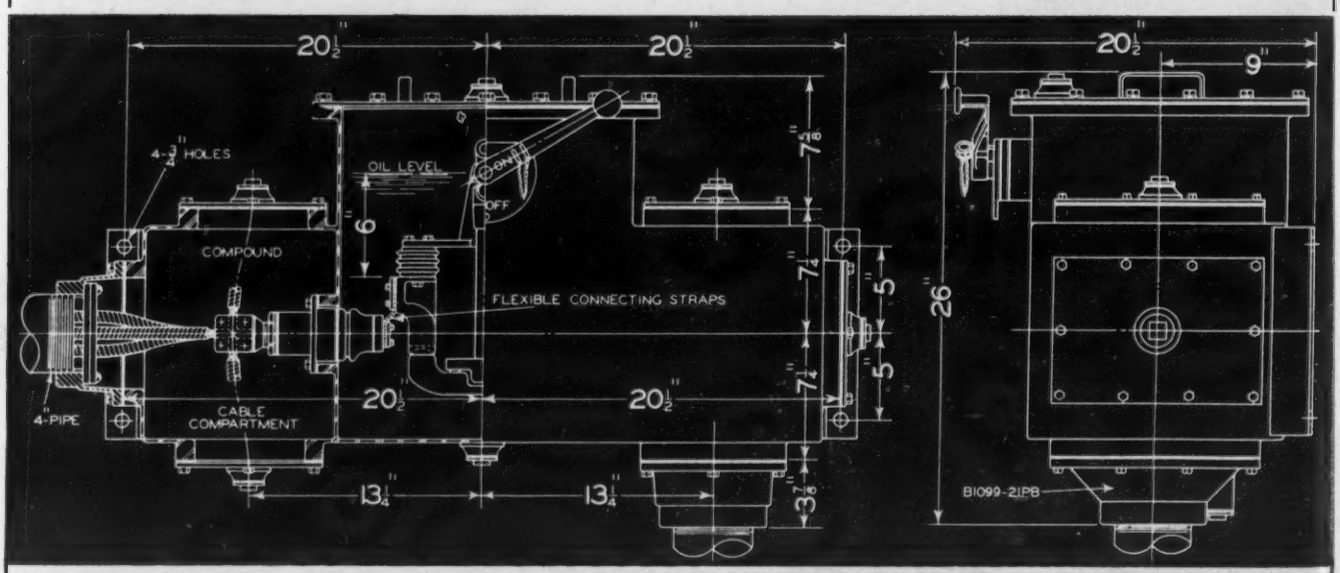
FOR CLASS 1, GROUP D, HAZARDOUS LOCATIONS

Cable terminating lugs are solderless clamp style for a wide range of conductor sizes. Cable compartments are to be solidly filled with compound. Using an extra conduit cable entrance (and special conductor clamp lugs) two circuits can terminate in one compartment.

Cables are sealed with style "PB" fitting, which is drilled to fit. Lead sheaths are belled over and clamped. Non-leaded cables are sealed by cord packing.



The switch chassis unit can be lifted out of the tank by removing the nuts from the 3 guide rods and the cap-screws from flexible connecting straps on each side. Switch contacts are high pressure ball and groove style.



QUOTATION: G & W Type "DIPK" single throw oil switch, 3 pole, 5000 volts, 600 amperes. Full load break. With 4" conduit cable entrance fitting on each side for 600 Mcm maximum cables. (Give complete cable data.)

CAT. No. DIPK346.....$300.00 list each. Approx. shipping weight.....600 lbs. each.
Oil for switch tank not included. 13 gallons required.....80c list per gallon.
Compound for two compartments not included. 17 gallons required.....$1.30 net per gal. in 5 gal. containers.
Extra 4" conduit cable entrance fitting for a branch tap on compartment. Cat. No. B1099-21PB.....$8.00 list each.

G & W ELECTRIC SPECIALTY CO., 7780 DANTE AVENUE, CHICAGO, ILLINOIS, U. S. A.

Send for your copy of new Bul. 543 listing other G & W oil switches

OUTSTANDING PRODUCTION ACHIEVEMENT

In recognition of the way in which Simplex has responded to the demands of the shipbuilding program, the U. S. Maritime Commission recently awarded to us the Maritime "M" Pennant and the Victory Fleet Flag for outstanding production achievement.

SIMPLEX SHIPBOARD CABLES FOR VICTORY SHIPS.....

With the rapidly expanding shipbuilding program there has been a corresponding increase in requirements for power and communication cables without which the ships cannot be operated. Production has been stepped up to meet the increased demand and Simplex shipboard cables are being supplied in steadily increasing volume.

They are in service in all parts of the world where supplies are being sent to our allies or to our own military forces overseas. They are helping to maintain the "bridge of ships" that is a vital part of the military equipment of the United Nations.

Simplex cables for all types of service conform to government restrictions and regulations controlling the use of copper, rubber and other scarce materials but they may be depended upon for satisfactory performance. If you must have cables for essential, high priority war work, we shall be pleased to tell you what Simplex cables can do for you.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

Simplex
WIRES and CABLES

NO ROOM IN THE FILES! RECORDS SCATTERED ALL OVER THE PLACE! HOW CAN I GET ANY WORK DONE THIS WAY?
TRANSFER ROOM
SEEMS THAT EVERY RECORD I NEED IS IN THE TRANSFER ROOM
ME TOO, I WASTE MORE TIME JUST RUNNING BACK AND FORTH
SURE IS A NUISANCE TO HAVE TO FILE CARDS IN LETTER-SIZED DRAWERS, - WASTES SPACE, TOO!

HERE'S THE WAY TO MEET *THAT* PROBLEM

GUARDSMAN

WOOD FILING CABINETS

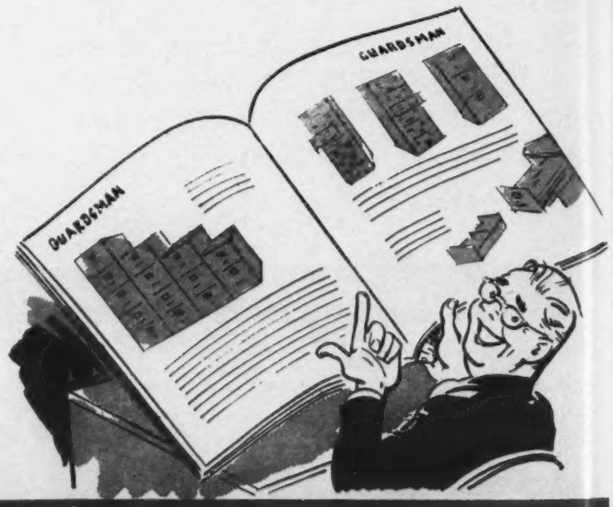
A STYLE AND SIZE FOR EVERY NEED. AVAILABLE FOR IMMEDIATE DELIVERY!

For complete details on this extensive line of wood files built to match existing equipment, write today for the free 20-page Guardsman catalog.

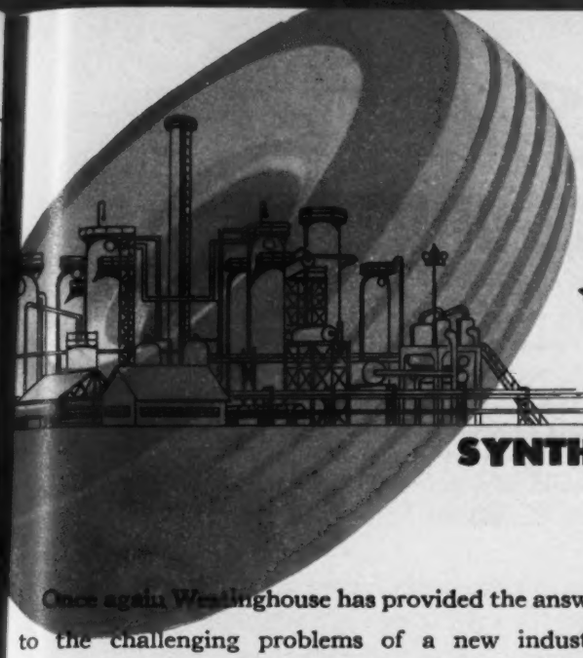
IS LACK OF EFFICIENT FILING EQUIPMENT WASTING *YOUR* TIME?

In these busy days you just can't afford to let inadequate filing equipment slow the work of your dwindling clerical staff. Today's flood of business papers, and those of years to come, may be efficiently filed in the attractive, built-to-last, Wood Guardsman Cabinet. Remember, too, that *innumerable government regulations require that many operating records must be kept for at least two years!*

The Guardsman line includes letter and legal size units in 2, 3, 4, and 5 drawer heights; and 5x3, 6x4, 8x5, 8x8, and Tabulating card sizes. Here is the simple, effective cure for excessive transferring, overcrowding, delayed finding, and makeshift adaptations of filing equipment. *See the Guardsman at your nearest Remington Rand Office.*



SYSTEMS DIVISION **Remington Rand Inc.** BUFFALO, NEW YORK



Speeding the day

WHEN THERE'LL BE ENOUGH SYNTHETIC RUBBER TIRES FOR EVERYONE

Once again Westinghouse has provided the answers to the challenging problems of a new industry. Control centers, originally developed to meet the need for quickly installed group motor control, are speeding production of the polymerization process vital to manufacture of synthetic rubber.

Because Control Centers are factory grouped and wired, they speed installation, save aisle space, and provide low-cost, safe motor control.

Control Centers can be located away from hazardous points, eliminating the expense of critical-material-consuming, explosion-proof controls. Starters may be mounted on both sides of Westinghouse Control Centers—the units are all of one width and the heights are multiples of the small size. This provides greater space-savings and flexibility to meet varying conditions.

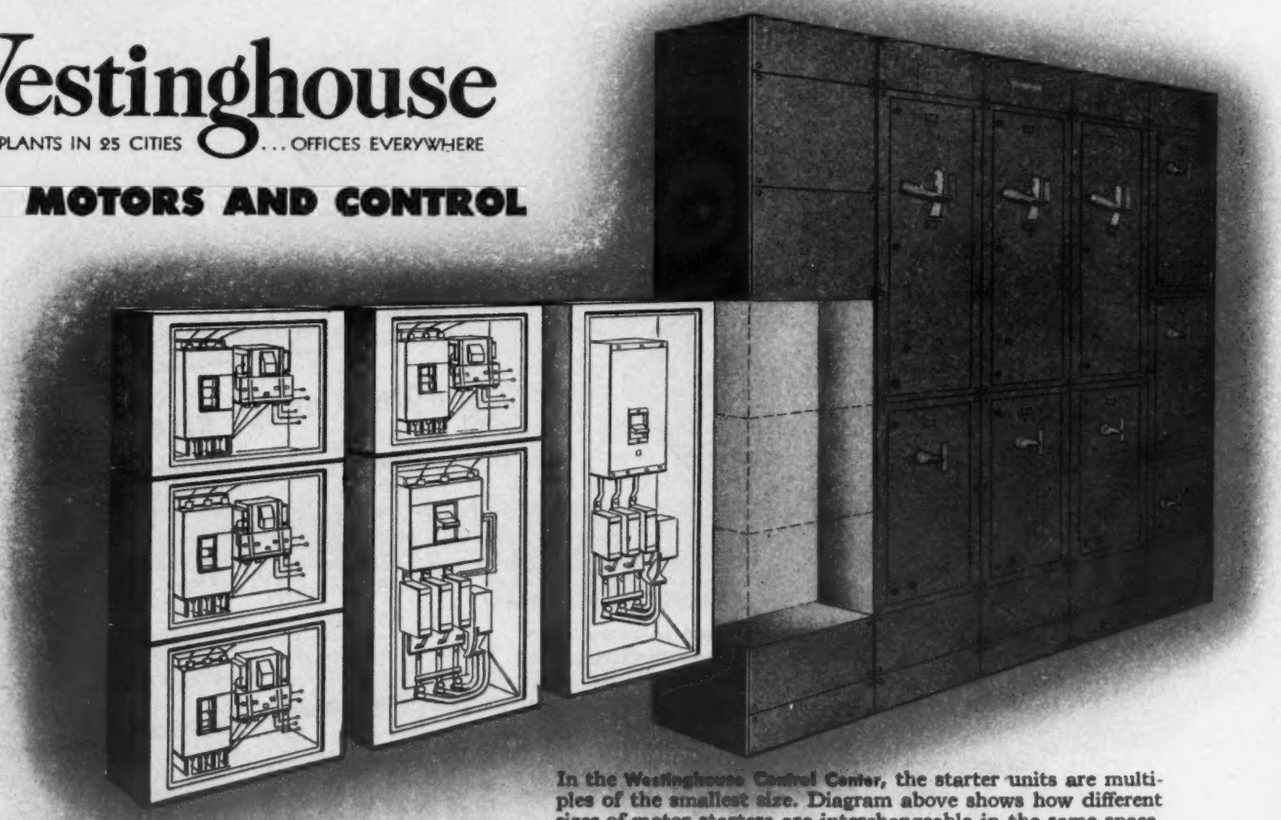
In short . . . Westinghouse Control Centers are the modern control for modern industry. Specify them for your plant . . . write for Booklet 3026 for complete details. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

J-21262

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

MOTORS AND CONTROL



In the Westinghouse Control Center, the starter units are multiples of the smallest size. Diagram above shows how different sizes of motor starters are interchangeable in the same space. The unit on the right encloses one Size 4 Linestarter; the two in the middle enclose a Size 1 and a Size 2 or 3 Linestarter; and the units on the left enclose three Size 1 Linestarters.

Dunco High Efficiency
RELAYS FOR SMALL-SPACE USE

It's much more of a trick to make a fine, accurate wrist watch than it is to produce an alarm clock. Similarly, the task of making really dependable and durable midget relays is one that calls for the best that a specialized manufacturer, already accustomed to high standards of quality, can give it—and here Struthers Dunn engineering excels.

As a result, Dunco Midget Relays have established new standards of performance in a wide variety of applications where space is at a premium, and where dependability under exacting conditions of use is essential. They are produced in dozens of standard and special types and sizes for almost any requirement. Dunco Midgets are Underwriter approved.

OTHER DUNCO RELAY-TIMER TYPES

30 ampere — Sensitive — Instrument Controlled — Low Voltage, Heavy Current, D. C. — Mechanical Latch-in (Electrical Reset) — Mercury Contact — Telephone Auxiliary — Lamp Controlling — Polarized — Overload — Timing — Sequence, Ratchet Type — Motor Reversing, and many others.

Write for the New Dunco Catalog and Relay Data Book.

26 Dunco representatives located in every major war equipment manufacturing center throughout the U. S. and Canada are trained to help you in all problems of relay selection and use. Write or wire for address of your nearest representative.

STRUTHERS DUNN, Inc.

1321 ARCH STREET PHILADELPHIA, PA.

Now-

COPPER-SAVING

COPPERWELD

BARS and WIRE

[providing either 30% or 40% of the electrical conductivity of solid copper of same cross-sectional area --- copper exterior inseparably molten-welded to steel core.]

This form of Copperweld suggests such important copper-saving applications as: busbars (when size must be maintained but limited conductivity required)—blades, jaws and other parts in knife blade switches—fuse clips—jumpers—flat conductors—lugs—and miscellaneous electrical parts usually made of flat copper, brass, or bronze.

Copperweld is not a universal substitute for copper but may be used for many applications where copper, brass, or bronze is used.

Please write, supplying detailed information concerning intended copper-saving use, including material and size now used and required conductivity (in amperes) of the parts to be made of Copperweld. A drawing of the part will be helpful.

COPPERWELD STEEL COMPANY GLASSPORT, PA.

COPPER SAVING ROUNDS & FLATS

COPPERWELD

This
NEWSPAPER
advertisement was published in Washington, New York, Chicago, Detroit and Pittsburgh, to create a better understanding of business.

How "SEED MONEY" benefits labor

HERE'S a little of the stuff that makes horse races:

We sent reprints of a couple of recent "Seed Money" advertisements to labor leaders.

Among the replies was the letter from a west coast labor leader quoted below.

While this letter disagrees with us completely and probably does not represent the ideas of most labor leaders, it does express a viewpoint that should have the careful attention of all who are genuinely interested in better living.

We believe that a healthy, competitive and constantly improved industry is the source of all good living. Here is a frank statement of an entirely different viewpoint:

"March 31, 1943

McGraw-Hill Publishing Co. Inc.,
McGraw-Hill Building,
330 West 42nd Street,
New York, N. Y.

Gentlemen:

We have received your letter of March 24th, together with your two pamphlets, "Where Do Wage Increases Come From?" and "Where Do Jobs Come From?" and I must say they are about as superficial a work as I have seen.

In the first place good business is not the source of good living or wealth either. All wealth comes from and is created by labor and nothing else. Even gold in the ground is valueless until labor is applied to it.

Your whole theory is based on a finished system of production for profit instead of production for use.

My only purpose in writing you concerning this is that I believe you should explore the current leading thought of the world in regard to postwar planning and the broad conviction obtaining that we cannot go back to an economy built on "seed money" or any other such artificial economic mortar to reconstruct a torn world where production to effect a world of abundance for all is no longer a secret or difficult.

Very truly yours,"

(To avoid any flavor of personal controversy, we have omitted the sender's name)

► If you are inclined to agree with the author of this letter (many in the ranks of labor do not), then you are invited to study the two men in the picture above.

Both men are laboring . . . If laboring is the source of good living, then the coolie ought to live better than the American, because he works harder and longer.

Is it because the coolie is dumb that he cannot live as well with his home-made plow as the American with his tractor? . . . Ask the Japs how dumb that coolie is!

No, the American lives better because his labor is multiplied by efficient tools.

Since labor cannot be effective in providing

[FREE MATS: If you would like to publish this message over your own company name, or distribute it in handy booklet form, write or wire: Research Dept., McGraw-Hill Publishing Company Inc., 330 West 42nd St., New York.]

How "Seed Money" benefits labor (cont'd)

better living without tools, then it certainly seems reasonable that every laboring man would want to use the best tools he could possibly get his hands on.

"Industry" exists to supply the tools that produce better living. "Business" exists to store, distribute and sell the products of tools.

The better the tools, the better the living of the men who use them.

Therefore, the laboring man ought to be in favor of the system that will improve his tools most rapidly.

Throughout the ages, men have tried every conceivable system to produce improved tools. The best way yet developed is our American one. It has many faults, but we should work to improve it, not discard it.

► Our American method of developing better tools for workmen has two parts. One is called "capitalism." The other is called "profit."

"Capitalism" encourages people to save, because it promises to repay anything that is loaned, and to reward the loaner.

"Profit" encourages people to think, because it gives an automatic reward to anyone who can do a job better.

Capitalism and profit get more work done in less time because they encourage and reward work. To talk of abolishing them is as ineffective as abolishing arithmetic. Their flaws are errors of operation, not of fact.

They can be made to create jobs for everybody. They can pay the war debt. They can accomplish any job within the imagination of man IF properly administered.

In the problems of the post-war world, we will need, as never before, the "take a chance" spirit which is the essence of capitalism. We will need the "I can do it better" spirit which can best be encouraged through allowing a profit.

► Here is the way capitalism and profit can be made to benefit labor and produce better living:

1. Constantly improve the equipment available for the worker.
2. Use the lowered costs thus produced to
   (a) lower prices to consumers
   (b) raise wages
   (c) provide incentives for invention, leadership and investment
   (d) lay aside "Seed Money" that can be used to start over again at item 1.

"Seed Money" produces better living

► America has always been an inventor nation. Throughout the years, most of the profits of business have been used to buy inventions . . . better machines, more efficient factories, research for better products. We call profit that is "plowed back" into business "Seed Money." Through Seed Money, products are constantly improved, making possible lower prices and higher wages.

Did you know that this process of putting aside Seed Money has been almost entirely eliminated by our tax law?

Congress, in shutting the door on wartime profiteers, wrote the Excess Profits Law in such a manner that it also takes away most of the Seed Money of business.

Industry must have Seed Money to continue the work of making better products available at lower costs, to create more jobs and pay higher *real* wages. The Excess Profits Law must be changed if we are to provide Seed Money for making post-war jobs. If you think so, too, ask your Congressman to review this law and all laws —with this principle in mind:

"Industrial Progress
is the Basis of all Good Living."

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

22 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

This advertisement is available in handy booklet form. (Less than 100 copies free. Larger quantities, $1.50 per 100; $10.00 per 1000.)

McGRAW-HILL

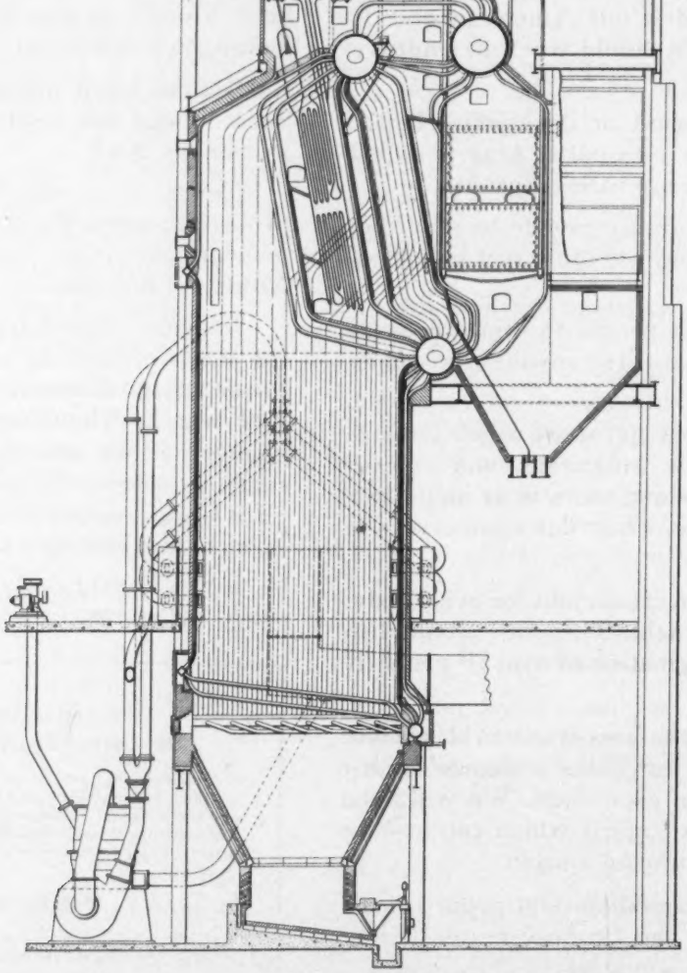
PUBLISHING COMPANY, INC. . . . BOOK COMPANY, INC.

330 WEST 42ND STREET, NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

American Machinist • Aviation • Bus Transportation • Business Week • Coal Age • Chemical & Metallurgical Engineering • Construction Methods • Electrical Contracting • Electrical Merchandising • Electrical West • Electrical World • Electronics • Engineering & Mining Journal • E. & M. J. Metal and Mineral Markets Engineering News-Record • Factory Management & Maintenance • Food Industries • Mill Supplies • Power • Product Engineering • Textile World • Wholesaler's Salesman • Business Publishers International Corporation, an affiliate, publishers of Business and Technical Magazines for Latin America, and Overseas Circulation.

12 MONTHS OF WAR-TIME ST



The performance record described on the right-hand page was accomplished by this C-E Steam Generating Unit. Maximum Continuous Capacity – 225,000 lb of steam per hr. Design Pressure – 900 psi. Total Steam Temperature – 900° F.

C-E

This is the ninth of a series of impressive war-time performance records of utility installations.

E STEAM PRODUCTION

USE FACTOR-96.9%

Another C-E Steam Generating Unit turns in a remarkable record of service in a mid-west public utility that is supplying victory kilowatts to a score or more of vital war production plants.

Toward the end of our first year "at war" this unit completed a 12-month's run in which it was on the line for all but 11 days. That's a use factor of 96.9 per cent. The outages were mostly of one day duration on week-ends, eight being due to fan bearings and three to the main unit. Following this run the unit was taken off the line only to permit turbine and boiler inspection and general cleaning.

The record is even more impressive in view of the heavy load carried during the year. The average output was 200,000 lb of steam per hr — approximately 90 per cent of the maximum rated capacity. The average efficiency for the entire year was 89.2 per cent, a figure well above the original guarantee.

The outstanding performance of this installation may also be cited as another example of the remarkable performance of America's public utilities generally. For our great electrical utility system has the unique distinction of having met the enormous war demands for its products with relatively little addition to existing facilities and correspondingly small demand for critical materials.

A-731

COMBUSTION ENGINEERING

200 MADISON AVE. NEW YORK, N. Y.

Save to Win with these four simple rules of battery care:

1. Keep adding approved water at regular intervals. Most local water is safe. Ask us if yours is safe.
2. Keep the top of the battery and battery container clean and dry at all times. This will assure maximum protection of the inner parts.
3. Keep the battery fully charged—but avoid excessive over-charge. A storage battery will last longer when charged at its proper voltage.
4. Record water additions, voltage, and gravity readings. Don't trust your memory. Write down a complete record of your battery's life history. Compare readings.

If you wish more detailed information, or have a special battery maintenance problem, don't hesitate to write to Exide. We want you to get the long-life built into every Exide Battery. Ask for booklet Form 3225.

Exide
CHLORIDE BATTERIES

. . . is a vital principle of utility operation!

Conservation of materials is no new story to American utility men. With thrift and efficiency they have always planned for conservation.

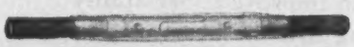
They've squeezed the last ounce of use out of materials in their care . . . and today, that need is intensified.

One helpful principle to follow is that of "Buy to Last—Save to Win." Buy quality products and equipment, then care for them to avoid needless replacement. That conserves raw materials, labor, and space in factories. It frees these productive elements for essential war production.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
Exide Batteries of Canada, Limited, Toronto

The Burndy LINKIT
(closed position)

The LINKIT Lug



The LINKIT with Burndy
VERSIFLEX insulating
sleeve

Headquarters for Connectors

Again, Burndy solves a small wire connection problem in a simple, foolproof manner.

The LINKIT is a detachable connector, positive in its action, and without any troublesome, extra parts . . . parts which might loosen or become lost.

It simply z-i-p-s into position, yet establishes a sound, secure contact over its entire fork contact area. To disconnect, a firm pull releases the contact grip, and it zips apart. Either operation wipes contact surfaces *clean.*

And the LINKIT provides a *sound* connection, mechanically as well as electrically. For it's forged from pure copper. *Pure copper for high conductivity . . . forging for high strength.*

Another advantage . . . the LINKIT is a modern solderless connector, attached in the same speedy and secure manner as popular Burndy HYLUG terminals . . . *simply indented to the wire with a Burndy HYTOOL.*

Samples of LINKIT, and other Burndy solderless connectors for small wires, will gladly be sent on request.

BURNDY ENGINEERING CO., INC., 107 Eastern Boulevard, N.Y.C.

BURNDY

"SEE-ABILITY"

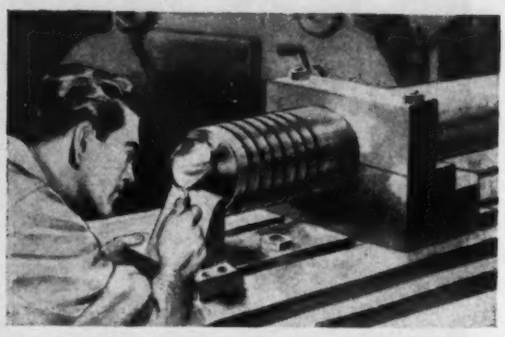
BORE TELESCOPE with strong interior light provides "SEE-ABILITY", permitting inspector to examine inside of gun tube.

NOT ONLY MORE GUNS, but better guns, are coming out of the arsenals of democracy. Better workmanship, greater accuracy are possible because of better "See-ability" over the lathes, boring machines, drills, and inspection benches.

Through its knowledge of modern lighting, Westinghouse is contributing daily to improved "See-ability" in our war plants. Knowing that the heart of good lighting is the lamp, Westinghouse has steadily improved quality. Today Westinghouse fluorescent lamps are brighter than ever, and they stay bright from end to end.

builds better guns

IN MODERN GUNS accuracy is checked at every step in manufacture. "SEE-ABILITY" aids these close inspections.



ACCURACY IN testing, grinding, machining, assembling, and hundreds of other operations depend on "SEE-ABILITY."

Join the "Sight for Victory" Program

The National Better Light-Better Sight Bureau has pointed up the wartime objectives of the lighting industry, starting with a check-up of seeing conditions in war production factories. We can all help in this important task and make the check-up complete by July 4, 1943. "See-ability" is a must for good workmanship, accuracy, and increased production. Let's all do our part in the "Sight for Victory" program, help win the war faster, and then we can all have the opportunity we have been waiting for. Westinghouse Electric and Manufacturing Co., Bloomfield, New Jersey.

JUST OFF THE PRESS! 32 page book, "SIGHT FOR VICTORY," prepared by National Better Light—Better Sight Bureau. Designed to be presented by lighting men to every war plant in America. Includes valuable check forms for comprehensive "SEE-ABILITY" analyses. Every lighting man should be familiar with this book.

Westinghouse

MAZDA LAMPS

FOR GREATER "SEE-ABILITY"

HOW TO GET THE RIGHT CONTACTS FOR YOUR JOB!

The fact that Stackpole makes practically all types of copper-graphite, silver-graphite, and rare metal composition contacts is important. Even more so, however, is the proved ability of Stackpole engineers to help customers select exactly the *right* contact for their job—then to use it to best possible advantage.

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The first molded silver-graphite contact which revolutionized circuit breaker and circuit control equipment design over fifteen years ago was a Stackpole development—and Stackpole contact engineering has continued to lead the way ever since.

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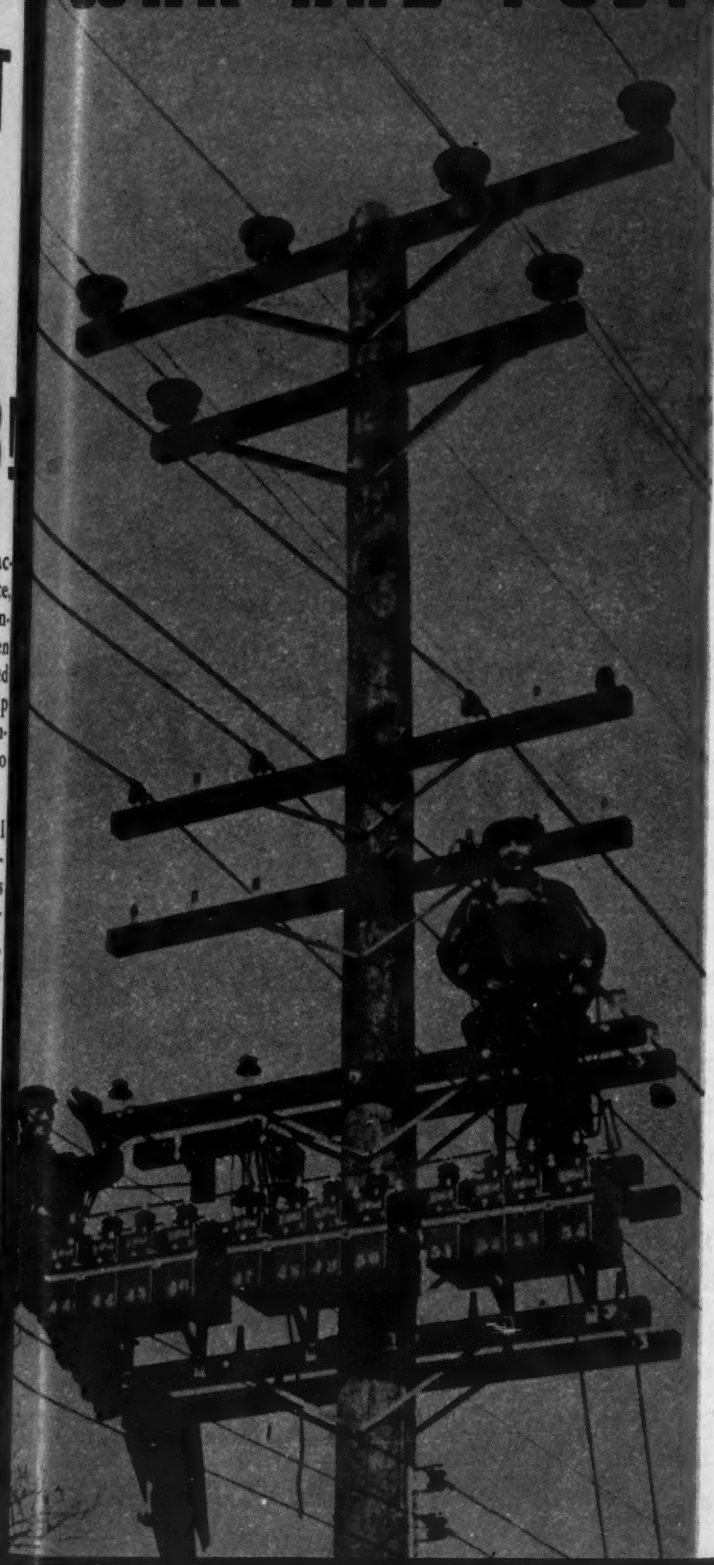

Much of the equipment now being installed will solve the problem of war-stimulated emergency loads. But, with the disappearance of these emergency load demands, not all of this equipment will be productive. And in the postwar race, every idle machine hour, every piece of equipment not operating at maximum efficiency will limit your competitive ability.

That is why many utilities are installing C-D capacitors. Here is equipment that will not only cure emergency load headaches — but also will prove productive in the postwar period. Today, you can take care of present emergency load requirements quickly and efficiently by installing C-D capacitors. And long after emergency peak loads have been forgotten your C-D capacitor installation will continue to produce for you twenty-four hours a day. Our engineers will be glad to show you how C-D capacitors can help increase system capacity now — and continue to work for you in the future. Cornell-Dubilier Electric Corporation, So. Plainfield, N. J.

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- ★ C-D Capacitors can be installed quickly and easily.
- ★ C-D Capacitors will increase the load-carrying ability of transmission, substation and distribution circuits.
- ★ C-D Capacitors have appreciably lower operating losses than other types of corrective equipment.
- ★ C-D Capacitors will have a high reuse value elsewhere in the system after the war.
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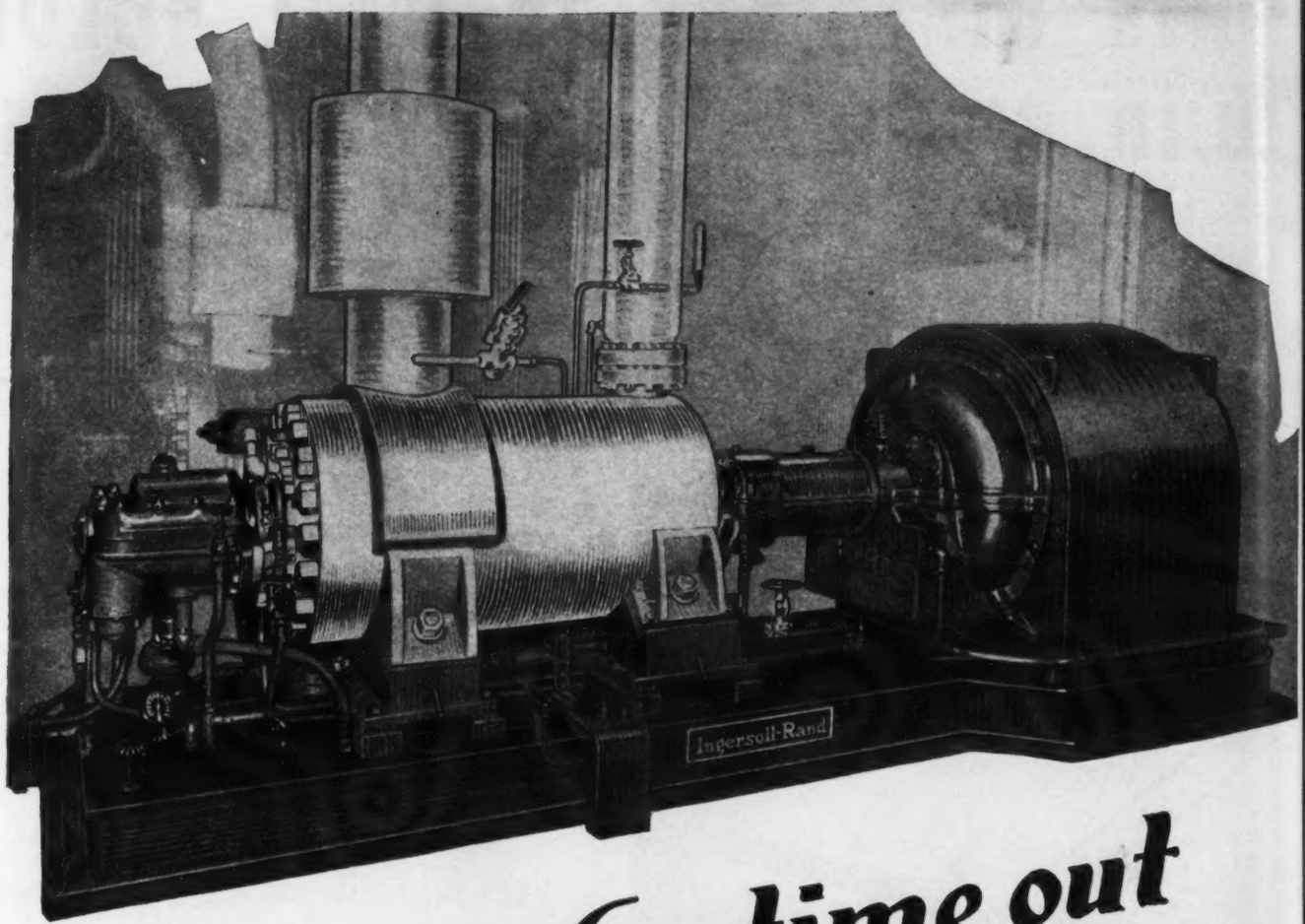

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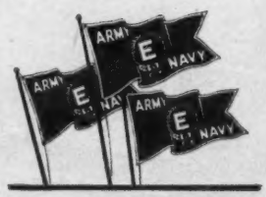

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NOTE: Through this Preventive Maintenance Plan you may uncover the evidence necessary to obtain an "emergency repair priority." This is explained fully in the plan book.

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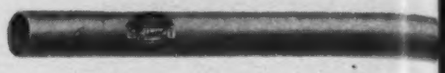

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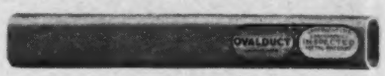

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"La-in" Metal Molding—4-Wire Surface Raceway

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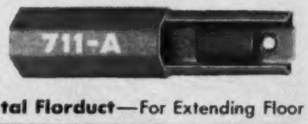
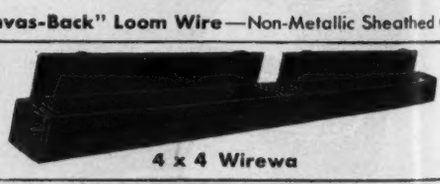


"La-in" Metal Florduct—For Extending Floor Circu

"Planeduct"—For Airplane Wiring

"Canvas-Back" Loom Wire—Non-Metallic Sheathed C



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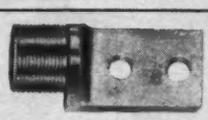

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Don't Waste Electricity

There is no room in war for preventable waste. Great as this country is, it needs every ounce of everything. Even where the supply is plentiful and is not rationed, as with electricity, it should not be wasted.

Why should this be? If there is enough and more, why shouldn't we do as we please with it? There are so many other things that are short and therefore rationed that it would be a pleasure to have something we didn't have to be careful with.

That would be all right if there were no other entanglements, but in the case of electricity, fuel is involved. But there is plenty of coal. Yes, but how about transportation and lamp bulbs? In other words, it isn't just as simple as having enough generating plant capacity.

There is no thought in the minds of those in WPB who have charge of the conservation program that consumers should reduce any essential use of electricity. It isn't as though there were a shortage and every one had to take a cut. It's just that, as a matter of common sense, electricity must not be wasted.

This doesn't mean the cessation of promotional efforts. On the contrary, the utilities would be doing the war effort a disservice if they stopped all promotion. Because promotion is as necessary to economy in the use of electric service as it ever was to load building. As a matter of fact, it would be difficult for any one to find much, if any, utility promotion that isn't geared to the war effort. Such things as food preservation, nutrition and eye conservation are designed to prevent waste.

On the other hand, utilities are not giving the nation their full support in the conservation program if they ignore any waste of electricity. Nor is it going to be sufficient just to give lip service to the idea. The customers must be urged over and over and over again not to waste. They must be shown how to conserve.

A small group of utility leaders at the invitation of the Council of Electric Operating Companies who met last week with the heads of the Office of War Utilities put the spirit of the matter into a slogan:

"Waste in war is a crime; don't waste electricity just because it isn't rationed."

Just as the industry has co-operated wholeheartedly in all other conservation programs, so can it be expected to get behind this one.

It will hurt in the pocketbook—and hurt plenty—because a substantial number of consumers will go beyond conservation and reduce essential uses. In fact, there is considerable of this right now. But that is beside the point. If utilities balked at doing things just because it hurt the pocketbook they never would have been able to turn in the glorious war record that is theirs.

If there are some who fear that this may be a reflection on an industry that has just boasted of having plenty, let them ponder if perhaps it might not be a more serious reflection if they alone did not have to conserve.

Once the industry understands what is expected of it—and it does now—it will do everything in its power to make it work.

If electricity is wasted, it will be in spite of the efforts of the industry.

Cables–How to Make Them Last–I

How to inspect and maintain all types and kinds of power supply cables in industrial plants in both stationary installation and in portable use — Avoidance and correction of harmful conditions and practices

R. B. McKINLEY and L. D. MADSEN, Cable Division, General Electric Co., Schenectady, N. Y.

UNTIL the present time the comparative ease with which damaged cables could be replaced has resulted in the almost total neglect of cable maintenance or care in the usual industrial plant. This neglect, plus improper installations and applications, in many cases has resulted in considerably shortened average life of cable in industrial service. The purpose of this article is to suggest practical steps which may be taken to add years of useful life to installed cable and to reduce cable failures and consequent production delays to a minimum.

Are Cables Overloaded?

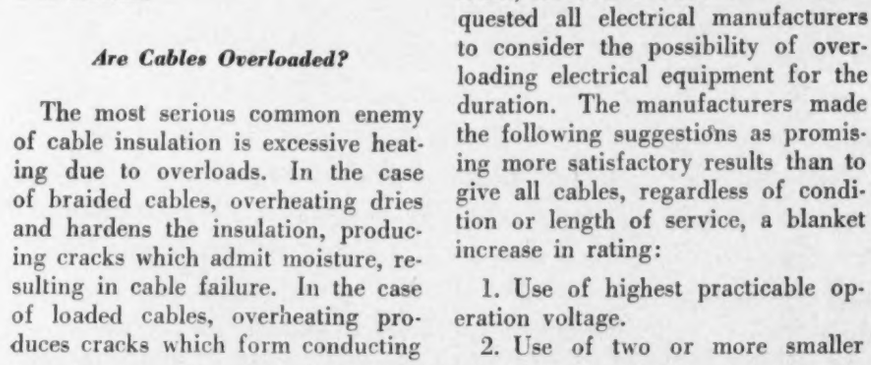
The most serious common enemy of cable insulation is excessive heating due to overloads. In the case of braided cables, overheating dries and hardens the insulation, producing cracks which admit moisture, resulting in cable failure. In the case of loaded cables, overheating produces cracks which form conducting paths to the sheath and eventual failure, even though moisture is not present.

Usually when a cable has become hardened by overheating, any attempt to repair one failure will only result in further cracking and further failures. Therefore it is of the utmost importance that cables be checked for overloads and excessive temperatures, and wherever the recommended conditions are exceeded steps should be taken to relieve the conditions.

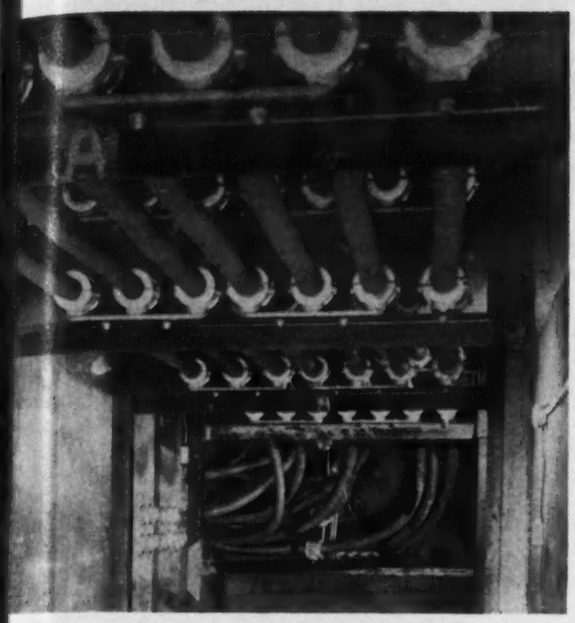
In an effort to make existing facilities serve increasing industrial loads, the War Production Board requested all electrical manufacturers to consider the possibility of overloading electrical equipment for the duration. The manufacturers made the following suggestions as promising more satisfactory results than to give all cables, regardless of condition or length of service, a blanket increase in rating:

1. Use of highest practicable operation voltage.
2. Use of two or more smaller cables in parallel instead of one large cable in certain cases.
3. Improving thermal dissipation conditions by (a) eliminating thermal bottlenecks, (b) forced ventilation, (c) soil wetting, (d) relocation of sources of external heat, (e) cable rerouting, and (f) avoiding close grouping of a number of cables and spreading them to dissipate heat.
4. Improving power factor of load.
5. Locating transformers to reduce length of secondary cables.
6. Increasing allowable line drops wherever conditions permit, thus conserving copper.
7. Operating all existing circuits at full allowable loadings, reconnecting spare and partially loaded circuits, where possible, to accomplish this.
8. Salvaging miscellaneous lengths removed during repair and alterations for reuse at other locations.
9. Using buried cables instead of duct cables where practicable.
10. Using cables exposed in air in preference to cables in conduit where practicable.
11. Selecting cables on a basis of normal operations rather than for occasional overload.

Naturally, all of these suggestions cannot be applied to cables already in service. Also, some of these suggestions should be applied with caution because many cables which have been operating for years at or in excessive temperatures may continue to operate for a long time *if they are not disturbed.* In the case of many of these old cables, if they are moved to eliminate "thermal bottlenecks" the insulation may crack. Therefore, in cases where the insulation is known to be dried out, some



FLOW of heated air around loaded cables racked vertically (A) may make it necessary to reduce ratings of upper cables. Baffles to deflect air flow (B) will improve the situation. Unrestricted heat flow produces little mutual heating if cables are properly spaced (C). But if heat is reflected and confined (D) heating may be severe. When one cable is used as a messenger for the other, the two bound together (E), mutual heating is maximum and capacities of both cables are seriously reduced



CABLES grouped like this should be derated because of mutual heating

remedy other than changing the location of the cables should be applied.

There are suggestions in the above list, however, which can well be applied to the cable circuits in many industrial plants. If the electrician will survey his cable circuits with this list in mind, opportunities for improving the thermal operating conditions of many cable circuits will be found.

Cables in Racks

Racking cables one above another along the walls of a building (A) is a very common method of installation, but one which causes the upper cables to operate at excessive temperatures due to the heat rising from the cables below. Calculations have shown that the ratings of these upper cables would have to be decreased 15 to 33 percent to prevent excessive temperatures.

However, since the aim is to increase the ratings rather than decrease them, baffles can be placed between these cables (B), which will deflect the rising current of warm air and permit the upper cables to operate in much the same ambient temperature as the bottom cables.

If the cables are racked along the outside wall of a building, the baffles can be made to do double duty by shading the cables from the sun. Tests made on lead pipe indicated that during the middle of the day the temperature of a cable in the sun may be 20 deg. C. higher than the same cable in the shade due to the heat absorbed from the sun's rays.

If the cables are arranged horizontally (C), the mutual heating between them can usually be neglected unless they are in a confined space (D) or close to a ceiling or a similar surface from which the heat will be reflected. The minimum center-to-center spacing between cables from a mutual heating standpoint should be twice the diameter of one cable. Of course, if voltage drop is a more important consideration than current-carrying capacity, the spacing between single-conductor cables should be kept as small as possible to reduce the reactance.

Frequently a large cable installed previously is used as a messenger by attaching a smaller cable to it by means of tape or wire (E). The mutual heating in this event is maximum and the allowable capacity of both cables will be severely reduced. These cables must be separated if possible.

Cables in Floor Channels

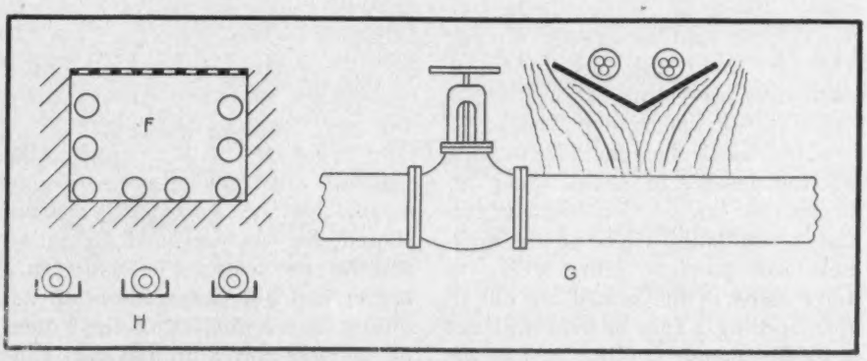
Another common method of installing cables is to place them in covered channels in the floor. This is usually a good location since it is cooled by the surrounding earth. Frequently, however, these channels are overcrowded and closed with solid covers which do not permit a satisfactory circulation of air. This results in overheated cables and shortened life.

Wherever practical, the coverings over these cable channels should be perforated to permit a circulation of air, and the cables in the channel should be racked (F), rather than piled on top of each other. The space within a channel is usually too small to permit the use of baffles to limit mutual heating and improving the air circulation is about the best remedy for overheating.

Cables in Tunnels

A favorite place for cables running between buildings is in the underground tunnel which carries other services such as steam and water lines. The presence of steam lines creates an ambient air temperature in the tunnel which may run as high as 80 deg. C. This temperature permits a rise of only 5 deg. C. for varnished cambric cables and is 30 deg. C. above the recommended copper operating temperature of many types of rubber insulation.

Many instances are known of cables which have been operating for several years under such conditions as described above, but the fact still remains that these cables are operating considerably above the temperature which has been found to give the maximum economical life. Unfortunately there is no very practical way of improving the thermal operating conditions of cables in such locations. The floor of the tunnel is the coolest place and the cables should be placed in that location if pos-



CABLES in floor channels (F) should be arranged to minimize mutual heating and cover should allow free circulation of air. A non-magnetic shield or baffle (G) protects cables from external heat. Avoid placing single-conductor cables in channels of magnetic metal (H) or in wide separation against magnetic surfaces

sible. Here again, however, the earlier warning about moving cables with old dry insulation should be observed.

If the tunnel is of reasonably short length and the cables are well grouped, an insulated inclosure could be built around the cables and air blown through for cooling. Or if the tunnel contains only one steam line, it might be more economical to cover this line with several inches of insulating material to keep the tunnel ambient at 40 deg. C. or below.

If the tunnel contains no steam lines and the temperature is still too high, blowing air through the tunnel will greatly improve the thermal conditions.

Cables in Underground Ducts

Overloads in duct banks may result from adding cables to the duct system without reducing the ratings of the cables already in the bank. That is, the rating of one of six cables in a duct bank will be higher than the rating of that same cable with nine or twelve others in the bank, and if the number of loaded cables in a bank is increased, the rating of those already there should be decreased accordingly.

Overloads can also result from gradually growing loads on cables already fully loaded. These loads, added in small steps, often reach a total which badly overloads the cables before the total magnitude of the increases is realized.

If loads have been added or if the cables in a duct bank have been increased in number, a check should be made to see that these cables are not exceeding their proper ratings. If the ratings are exceeded, an attempt should be made to transfer part of the load to another circuit. This is about the only practical method of preventing overheating of cables in an underground bank.

If one particular manhole contains a large number of cables some improvement can be obtained by putting a ventilating cover on the manhole and possibly using a fan to force some of the heated air out of this opening. This method will not provide enough cooling within the duct run itself to be worth the trouble and expense, and consequently should be considered only for congested manholes or short congested duct runs into a substation or switch house.

Flooding of duct banks is an extreme measure and should be done only as a last resort for a heavily overloaded bank. Cracks in the sheath or other faults may allow water to enter the cable. The complications at the ends of the duct run and the delay which would result in pumping out the run before any maintenance could be done make this measure a quite impractical one. If running water is used, there is danger of eroding away the cable sheath. The use of running water or flooding may bring corrosive agents into the bank and the presence of moisture usually speeds galvanic corrosion.

Cables Buried in Earth

Smaller sized buried cables are normally given a slightly higher rating than cables in underground ducts, but can as easily be overloaded. If a buried cable is found to be carrying too much load, some improvement may be obtained by keeping the earth moist at all times. This can be done by occasional soaking or by providing shade or a covering of fine soil or sand, which will cut down the rate of drying out of the soil. The only other means of relieving an overloaded buried cable is to switch part of the load to another circuit.

Aerial Cables

Overloads on aerial cables can be relieved to some extent. If more than one single-conductor cable is in the same rings, their ratings can be increased about 15 percent by spacing them apart in separate hangers. If cables are strung along the side of a building in the sun, some increase in rating can be obtained by shading the cables as mentioned under "Cables in Racks."

Conduit Risers

Risers are frequently a source of trouble because the cable is usually chosen for underground operation and the riser operates in conduit at a higher ambient temperature. In addition, the warm air from the bottom of the riser moves up and surrounds the upper end of the cable. One method of reducing the effect of this rising warm air is to prevent its being trapped at the top of the conduit by providing a ventilating bushing at the top.

Cable risers outdoors should be shaded from the sun.

External Sources of Heat

Frequently it is necessary to locate cable runs near a source of heat such as a steam line, furnace, boiler, etc. Since the ambient temperature at this point is higher than normal, the cable will be overheated if carrying loads based on normal ambients. To eliminate this source of trouble, the cable should be shielded from this source of heat (G), or either the cable or the heat source should be relocated.

If the heat source and cable run are close together for only short distances, fans may be applied to circulate cooler air over the cables and thus minimize the heating effect.

Short-time Overloads

Cables are frequently called upon to carry overloads for short periods of time each day or during emergencies. These overloads as well as the long-time overloads should be taken into account during a load survey.

Normally a cable can withstand a short overload without excessive damage to the insulation, if the operation prior to the overload has been below the rating. There are so many variables to be considered in this connection that the safest rule is to avoid any overloading, either continuous or short time.

If overloads of short duration cannot be avoided, an attempt should be made to apply artificial cooling to the cable. One method of cooling which could be applied to fairly short runs is to place fans which would cause an air flow of 3 to 5 miles per hour over the surface of the cable or conduit during the overload periods.

Magnetic Losses

Single-conductor leaded cables may be installed on or near the surface of a steel beam or wall. Reduction in current-carrying capacity up to 15 percent may result from this type of installation, depending upon the size and spacing of the cables and the distance to the steel plate. Therefore, large cables on the surface of a steel plate should be held off by means of insulators or wood blocks and moved

as close together as practical without causing mutual heating.

Cables 250,000 cir.mil and smaller are not adversely affected by the proximity of steel, and in close spacing may show an actual increase in rating due to the thermal-dissipating effect of the steel.

Single-conductor cables should not be run in individual conduits or in any other way wholly or partially inclosed by magnetic metal (H). One instance is known of single-conductor cables which were laid in a trench with an angle iron over each one for mechanical protection. These cables failed in a very short time due to heating of the magnetic covering.

Heating Due to Miscellaneous Causes

Low voltage at the utilization or receiving end of the line will require additional current to maintain the same power output. Therefore, increasing the voltage at the receiving end of the line by reducing the voltage drop or by raising the voltage at the sending end will reduce the load on the cable.

The voltage drop can be decreased by moving widely separated single-conductor cables closer together to reduce reactance. But the cables should not be moved so closely together that mutual heating will reduce their capacity.

Voltage at the sending end can frequently be increased by taking advantage of transformer taps, thus reducing the current required at the load. If a load can be operated at a higher voltage — for instance, 440 volts instead of 220 volts—this change-over will eliminate overloads on cables.

Low power-factor loads draw heavy currents and are frequently the cause of cable overloading. Power-factor improving equipment in the form of shunt capacitors can be applied to raise the power factor and reduce the load on the cable.

Unbalanced single-phase loads on a three-phase circuit may overload one or two of the phase wires. Loads should be checked and reconnected if unbalance exists.

If single-conductor cables are operated in parallel, attention must be given to arrangement of the conductors within the group to prevent unbalanced reactance, which in turn causes unbalanced currents to flow.

Metering Interchange and Supply Facilities

Service to war production plant involving two interconnected utility systems employs totalization of both energy supply and demand—Provision made for uninterrupted measurements

H. M. JOHNSON, Meter Engineer,
New England Power Service Company, Boston

WAR PRODUCTION and its urgent requirement for assured power supply has established many fairly complex service interconnections. These requirements have involved not only several services at separate locations for the same manufacturers' plants, due to extension of such plants, but also the need for service continuity assurance derived from more than one power source. The administration of power contracts under these circumstances has led to the necessity for the development of some rather interesting metering systems.

In one case the manufacturing plant is divided between two separate areas within one city interconnected by lines owned and operated by the manufacturing company. One of these areas is supplied by two parallel three-phase, three-wire cables from one of the generating plant buses of the local utility. The other area is served by looping through its bus a three-phase, three-wire cable forming one tie between the local utility's generating plant and an adjacent power company system. A second cable tie forms the third side of a triangular loop between the two supply systems.

Energy, Demand, Power Factor

A metering system was required which would supply the data necessary for the administration of two contracts, one covering delivery by local utility to the manufacturer and the other the interchange between utilities. Both contracts required determination of demand and energy. For the delivery to manufacturer determination of power factor at peak was also required.

The accompanying schematic diagram gives all essential details of the power supply and metering systems.

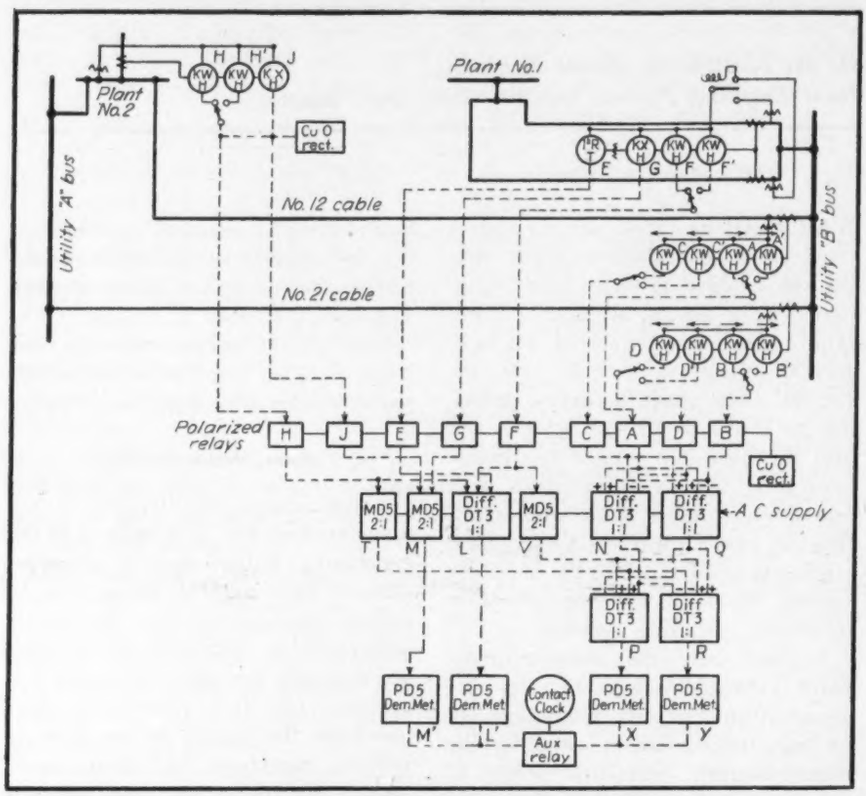
Loss Measurement

Since metering for delivery to customer's plant No. 1 is located at the generating station bus, it is necessary, to meet contract conditions, to deduct losses in the interconnecting power cables. Although these cables are normally operated with solid ties at both ends, it is possible to clear one from the circuit in the event of failure. Structural limitations necessitated the use of two separate sets of instrument transformers to cover delivery into the two cables. Totalization was accomplished by parallel connection of the current transformers and a selector relay to transfer meter potential connections in event of single cable operation. Measurement of cable copper losses is accomplished through the use of a standard I^2RT meter. Since this meter is available only in a 5-amp. rating, it appeared unwise to operate it above an arbitrary maximum of 7.5 amp. This limitation required the introduction of an interposing current transformer, for the I^2RT meter, with ratio $\sqrt{2}$:1. The loss meter kw.-hr. constant is then determined by the over-all current transformer ratio and the net resistance of the two

cables in parallel. In the event of single cable operation it is only necessary to switch the loss meter to direct connection with the line current transformers for correct operation, since in that case the resistance value is doubled.

Summation System Selected

Since totalization of both energy and demand is required, the summation system based on energy impulses was selected. The equipment used for combination of the various impulses



SCHEMATIC DIAGRAM of totalizing meter layout covering power supply to two industrial plants and operations of inter-utility tie cables

are General Electric Company type DT3 and MD5 totalizing relays. Based on local maintenance experience watt-hour meter contact devices of the type which have an open circuit period between alternate closures were selected. Experience had also indicated the necessity of keeping either the advancing or resetting solenoids of the DT3 relays continuously energized to prevent creeping in idle elements. To meet this requirement it was decided to operate local as well as long-distance circuits through auxiliary polarized relays having three-way contacts and no neutral contact position. This arrangement has the added advantage of greatly reducing the duty on the watt-hour contact devices, a matter of considerable importance to long-time operation.

The totalization of energy with such a system as this presents a vastly different problem from one in which load alone is required. While in the latter case short-time failures are carefully guarded against, nevertheless such loss of record is not fatal. On the other hand, any failure in an energy totalization is intolerable because in a system of this type, with several possible changes in power flow conditions, it is essential that the metering assembly, figuratively, view all system power flows simultaneously and see the *net* takings and deliveries continuously. Obviously, then, none of the energy meters can be interrupted in operation. To meet this requirement all energy meters are in duplicate and provided with switches which permit transfer of impulse control from one meter to the other. Such transfers are made when meters are tested periodically for inspection of contact devices.

Spare relays of each type are provided in such location with reference to the regular service relays that they can be "jumpered" into the circuits to replace any relay due for periodic inspection, adjustment or repair.

Operating Details

In operation, manufacturer's plant No. 2 load develops through meters *H* or *H'* and *J*, a series of d.c. polarity reversals, representing KWH and KXH, respectively. These are transmitted over two leased phone pairs to two polarized relays, which in turn deliver a.c. impulses to totalizing relays *T* and *L* and *M*. Similarly, manufacturer's plant No. 1 load develops with meters *F* or *F'*, *G* and *E* a series of d.c. polarity reversals representing KWH, KXH and line losses, respectively. These impulses are received by three polarized relays which deliver a.c. impulses to totalizing relays *L* and *V*, *M*, *L*, respectively. Delivery to manufacturer thus appears as total KWH and KW on demand meter *L'* and as total KXH and KX demand on demand meter *M'*.

Summation of net interchange between the two utilities is somewhat more complex. First, net interchange between the two systems at local utility company's main bus is developed on totalizing relays *N* and *Q* through impulse system similar to those described above. Relay *N* totalizes net KWH delivery of local utility to transmission company and relay *Q* the reverse.

For the purposes of operating control for the two power supplies it is necessary to assume that the total requirements of manufacturer's load is at all times divided equally between the two systems. Therefore, in determining the net exchanges between the two power companies it is necessary that the metering system develop proper debits and credits for such deliveries.

Normal Exchanges

The normal exchange between the companies is covered by the meters *A* or *A'*, *B* or *B'*, *C* or *C'* and *D* or *D'*, which feed impulses into differential totalizing relays *N* and *Q*. The retransmitting contacts and total cyclometers of relays *N* and *Q* then are proportional to the net deliveries of company A to company B and company B to Company A, respectively.

The output impulses of relays *N*

and Q are received on positive elements of differential totalizing relays P and R, respectively, and serve as the base for the further additions and subtractions necessary for determination of final quantities. In relay P, which is to develop the interchange credited to company A, there is added one-half the delivery to plant No. 2. Thus, the two positive elements of this relay sum up the total credit due company A. From this credit is then deducted one-half the delivery to plant No. 1, since direct delivery to this extent is the assumed responsibility of company A to the manufacturer. For conditions in which power flow over both interconnecting cables is in the direction from company A to company B, the result just reached in relay P is complete. However, if conditions were such that power flowed in to company B on cable 12 and in the reverse direction on cable 21 with the latter flow in excess of the former, it is necessary to allocate the excess to the credit to company B as direct delivery of its assumed quota of the No. 2 plant load. This is accomplished by deducting company B's net delivery, developed in relay Q, from net already reached in relay P.

Typical Operating Cases

Examples of operation under typical specific conditions will best serve to clarify operation of the system:

Case I — Assumed conditions:
Plant No. 1 taking 4,000 kw. = F or F'
Plant No. 1 taking 2,000 kx. = G
Plant No. 2 taking 4,000 kw. = H or H'
Plant No. 2 taking 3,000 kx. = J
Plant No. 1 delivery losses (E) neglected for simplicity
Cable No. 12 delivery toward company B = 3,000 kw. = A
Cable No. 21 delivery toward company B 2,000 kw. = B

Operation:
Relay $L = L' = F + H - E$ = 8,000 kw.
Relay $M = M' = G + J$ = 5,000 kx.
Relay $N = A + B - C - D$ = 5,000 kw. = Delivery to company B bus.
Relay $Q = C + D - A - B = 0$ (Relay detent prevents reverse rotation)
Relay $P = X = N + T - V - Q$

$$= 5{,}000 + \frac{4{,}000}{2} - \frac{4{,}000}{2} - 0 =$$

5,000 kw.

Since $T = H/2$ and $V = F/2$
Relay $R = Y = Q + V - T - N$

$$= 0 + \frac{4{,}000}{2} - \frac{4{,}000}{2} - 5{,}000 = 0$$

(Relay detent prevents reverse rotation)

Thus recorders M' and L' would show 8,000 kw. and 5,000 kx. delivered to manufacturer; recorder X would show 5,000 kw. delivery by company A to company B, which amount is comprised of 2,000 kw. credited for delivery to plant No. 2 on account of company B, plus 3,000 kw. delivered at company B bus in excess of one-half plant No. 1 requirements.

Case II — Assumed conditions:
Plant No. 1 taking 4,000 kw. = F or F'
Plant No. 2 taking 4,000 kw. = H or H'
Kilovars and Plant No. 1 losses omitted for simplicity.
Cable No. 12 delivery toward company A = 3,000 kw. = C or C'
Cable No. 21 delivery toward company A = 2,000 kw. = D or D'

Operation:
Relay $L = L' = F + H - E$ = 8,000 kw.
Relay $N = A + B - C - D = 0$
Relay $Q = C + D - A - B$ = 5,000 kw.
Relay $P = X = N + T - V - Q$
$= 0 + 2{,}000 - 2{,}000 - 5{,}000 = 0$
Relay $R = Y = Q + V - T - N$
$= 5{,}000 + 2{,}000 - 2{,}000 - 0 =$
$= 5{,}000$ kw.

Recorder M' would show 8,000 kw. delivered to manufacturer; recorder Y would show 5,000 kw. delivered by company B to company A, which amount is comprised of 2,000 kw. delivered at plant No. 1 on account of company A plus 1,000 kw. delivered at Plant No. 2 for account of company A plus 2,000 kw. delivered to company A bus.

Case III — Assumed conditions:
Plant No. 1 taking 4,000 kw. = F or F'
Plant No. 2 taking 4,000 kw. = H or H'
Kilovars and plant No. 1 delivery losses omitted for simplicity.
Cable No. 12 delivery toward company A = 3,000 kw. = C or C'
Cable No. 21 delivery toward company B = 1,000 kw. = B or B'

Operation:
Relay $L = L' = F + H - E$ = 8,000 kw.
Relay $N = A + B - C - D = 0 +$
$1{,}000 - 3{,}000 - 0 = 0$
Relay $Q = C + D - A - B = 3{,}000 +$
$0 - 0 - 1{,}000 = 2{,}000$ kw.
Relay $P = X = N + T - V - Q$
$= 0 + 4{,}000/2 - 4{,}000/2 - 2{,}000 = 0$
Relay $R = Y = Q + V - T - N =$
$2{,}000 + 4{,}000/2 - 4{,}000/2 - 0 =$
2,000 kw.

Recorder M' would show 8,000 kw. delivered to manufacturer; recorder X would show no delivery by company A to company B, since the 1,000 kw. reaching the company B bus in this direction was debited against company A on account of plant No. 1 load. Recorder Y would show 2,000 kw. delivered by company B to company A, which amount is comprised of 1,000 kw. credited for delivery to plant No. 1 plus 1,000 kw. credited for delivery to plant No. 2 on account of company A.

Early Difficulties Corrected

Early experience with this system was that commonly met in a complex assembly of this sort. A few of the watt-hour meters contact devices required readjustment after being placed in service. Similar adjustments were necessary in the meter control contacts of one of the MD3 type relays. One or two of the polarized relays required several adjustments to clear up inherent faults of operation. After an initial period of a few weeks, however, the system was brought into line and the experience of the ensuing several months has been completely satisfactory.

Incidental to operating this type of system it has been found that a high sensitivity (100 ohms/V) a.c.-d.c. voltmeter such as is used in radio service work is an invaluable tool. Connecting such a voltmeter across contact pairs of any operating contact device provides a visual check of operation not possible by direct observation of the mechanism.

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"Polectron" Synthetic Dielectric Material

New synthetic material has been developed, known as "Polectron" synthetic, which is said to have unusual softening temperatures and low dielectric loss. This new thermoplastic resin is produced in limited quantities at present by General Analine & Film Corporation. From tests the accompanying data have been obtained:

Heat distortion temperature.....140-160 deg. C.
Power Factor
One kilocycle to one megacycle, at 25 deg. C.....0.10% or less
At one kilocycle, from 25 to 100 deg. C.....0.10% or less
Specific resisitivity at 400 volts.....more than 10^{15} ohm-cm.
Dielectric constant (one kilocycle to one megacycle).....3.0

Dielectric strength...more than 1,000 volts per mil

By their properties "Polectron" products are claimed to be useful as dielectric materials for windings, water and moisture seals, radio condensers and other electronic equipment, without material changes in equipment or methods of manufacture.

Current-Carrying Capacity of Overhead Conductors

Multiplicity of variables leads to basic formulas which cannot be replaced by simpler formulas without the sacrifice of accuracy — Formulas and application table presented for maximum utilization of facilities

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SINCE the matter of current-carrying capacity of overhead conductors has become of such urgent interest under wartime conditions the author has studied the available data on which to base current-carrying capacity calculations. The desire to approach more closely the limiting values of current which might damage the conductor has brought about the necessity for the most accurate means of calculating the permissible currents. Until recently very little careful work has been done on this subject because of a lack of interest in it. However, interest in the heat transmission problems of mechanical engineering has stimulated careful research along that line which has produced quite accurate formulas which are equally adaptable to these electrical problems. Basic principles of heat conduction and radiation have been well known for quite some time. There is no disagreement among the various authorities as to the methods of calculation to be used for the usual applications.

Heat Dissipation

With regard to heat dissipation by convection the situation is not so fortunate. There are several theories as to the mechanism of convection and they are all difficult to express accurately in the form of formulas. This is primarily true because of the lack of sufficient experimental data. Formulas of this type which take proper account of all the factors involved are somewhat cumbersome, and one may be tempted to use the simplified approximate formulas which are presented in various texts. Those simplified formulas are quite satisfactory for cylinders larger than 1 in. in diameter, but, unfortunately, in the case of the usual sizes of wire they are quite inaccurate, the inaccuracies increasing rapidly with a decrease in wire size. The more complete formulas are recommended; they will not be found too burdensome.

Proper procedure in determining the current-carrying capacity of a bare conductor is first to decide upon the maximum allowable temperature for the conductor itself. Consideration should be given to the effect of temperature and its duration upon the strength or life of the conductor (this will be discussed in greater detail later in this article). The next step in the procedure is to decide as to the air temperature, wind velocity and earth temperature under which it is desired the conductor shall reach its maximum temperature.

Having made the foregoing assumptions, it is only necessary to substitute in the appropriate formulas those values together with the values of the factors which are dependent upon the kind and condition of the conductor. The heat balance for the equilibrium condition states that the watts generated in or absorbed by the conductor equals the watts dissipated from the conductor surface. Then the watts loss due to electrical resistance of the conductor plus the watts absorbed from solar radiation is equal to the watts dissipated from the wire by radiation and by convection.

Since an outdoor conductor usually has the possibility of having the sun shine upon it at the time of maximum current flow, the effect of the solar heat should be taken into consideration. Since the calculations easily show that its effect is considerable it cannot be safely ignored. Since, also, its calculation is very simple there is no good reason for ignoring it. Some have concluded, as a result of tests which they have not properly interpreted, that the effect of solar radiation is negligible. The reader should not fall into the same error.

Radiation and Convection

In determining the amount of dissipation by radiation it is essential that it be calculated by the application of a suitable formula. There is a considerable difference between the formulas for radiation from a wire in a closed room and for radiation from a wire outdoors. Indoors the radiation takes place from the wire to the walls of the room and objects in the room. Temperature of the receivers of the radiation should be used in the formula and not the air temperature. Outdoors the radiation takes place partly to the sky and partly to the earth and adjacent structures. On account of the difference in the formulas for the two portions of the radiation they must be calculated separately.

In calculating the dissipation due to convection for outdoor conductors it is usually considered that some air movement is always present, however small. In that case the formula for forced convection should be used. It is based upon the direction of air movement being at right angles to the axis of the conductor. Of course, there is always the possibility that the wind may blow parallel to the conductor at the time of maximum current. In that case the dissipation will be less, but no formula is available for calculating it. An approximation may be resorted to by consider-

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ing the wind to be crosswise but reduced in velocity, say by half. If one desires to be quite conservative with regard to this calculation of convection the velocity of the wind may be assumed at zero. In that case the formula for natural or free convection should be used.

Loss in Strength

It is desirable to refer again to the question of the maximum allowable temperature for the conductor. Even under wartime conditions it is usually thought best that the wire temperature should not reach a point or at least continue long at a point at which the wire might be permanently damaged. In the case of hard or medium hard drawn copper it is certain that it is undesirable to anneal the wire. Unfortunately it is not known definitely what combinations of temperature and time will just begin to anneal the wire. Too few tests have been made to determine those facts. Practically no tests have been made to determine the effects of heating under tension. There is some evidence that repeated cycles of heating and cooling have a cumulative effect, but the real extent is unknown. The effect of wire movement while hot is unknown and no correlation of change in elastic limit with change in ultimate strength has been made.

In view of the chaotic status of this problem at present it is not wise to propose radically higher operating temperatures, especially when adequate current-carrying capacities will be found for most wartime conditions with conservative values of conductor temperature. It is quite likely that past experience will show that a temperature of 80 deg. C. will not damage copper conductors under the usual loading cycles. Probably occasional short-time operation at around 95 deg. C. will not result in serious damage, although some tests have shown a slight reduction in strength after operating at 100 deg. C. for one hour. At any rate it is advisable to leave some margin to take care of transient overload conditions and short circuits.

In the case of weatherproofing covered conductors the calculations are much simplified by using the diameter over the braid as the diameter of the conductor in the formulas. This is entirely correct since all of the heat generated in the conductor by the current is conducted through the covering and is dissipated from the outer surface of the covering. It is necessary to assume a temperature for the outer surface of the covering which will be less than the maximum copper temperature by approximately the amount of expected temperature drop through the covering. With the usual copper temperatures the temperature drop may be taken as 10 to 15 deg. C. It is not necessary to know the exact temperature of the copper conductor, but it may be checked if desired by means of the conduction formulas (10) and (11). An error in assuming the copper temperature for the purpose of determining the conductor resistance is not serious because of the very small temperature coefficient of resistance.

Comprehensive Formulas

The author presents here the most complete and accurate formulas for wires which he has been able to find after careful study of the available data. It is recommended that these formulas be used rather than some short cut method. While they may seem complicated and difficult to use, that will not be found to be the case in actual use. Some may question why they have not been plotted into nomographic charts to simplify their use. It is doubtful whether satisfactory charts could be plotted from these complete formulas on account of the complex inter-relationships of the various factors. Even if such charts were plotted they would be complicated and just as difficult to use as the formulas themselves.

In using these formulas it is desirable to base all the calculations on a 1-ft. length of conductor. A slight variation in atmospheric pressure has very little effect upon the accuracy of the calculations and, therefore, it is advisable to assume this pressure at one atmosphere.

Heat Balance

$$I^2 R + W_s = W_c + W_r \text{ watts} \quad (1)$$

Solar Radiation Absorbed [1]

$$W_s = D\,L\,a\,S \text{ watts} \quad (2)$$

Convection

(A) Dissipation by natural convection[3]:

$$W_c = \frac{7.6 \times 10^{-6}\, T_a^{0.754}\, T_r\, A}{D \log_{10}\left(\frac{0.00438\, T_a^{0.877}}{D^{0.75}\, T_r^{0.25}\, P^{0.5}} + 1\right)} \text{ watts} \quad (3)$$

(B) Dissipation by forced convection[2]:

$$W_c = \frac{7.6 \times 10^{-6}\, T_a^{0.754}\, T_r\, A}{D \log_{10}\left(\frac{0.00061\, T_a}{(PVD)^{0.57}} + 1\right)} \text{ watts} \quad (4)$$

Dissipation by Radiation—Outdoors [1] [2]

(A) Radiation to the earth:

$$W_{re} = 36.8\, e_1\, e_2\, F_e \left[\left(\frac{T_1}{1000}\right)^4 - \left(\frac{T_2}{1000}\right)^4\right] A \text{ watts} \quad (5)$$

(B) Radiation to the sky:

$$W_{rs} = 36.8\, e_1\, F_s \left(\frac{T_1}{1000}\right)^4 A \text{ watts} \quad (6)$$

(C) Total radiation $= W_r = W_{re} + W_{rs}$ watts (7)

(D) $F_e + F_s = 1.00$ (8)

Dissipation by Radiation—in a Closed Room [1] [2]:

$$W_r = 36.8\, e_1 \left[\left(\frac{T_1}{1000}\right)^4 - \left(\frac{T_2}{1000}\right)^4\right] A \text{ watts} \quad (9)$$

Dissipation by Conduction Through Wire Covering [4]

(A) Heat Balance, $= I^2 R = W_k$ watts (10)

(B) $$W_k = \frac{t_d}{0.01202\, r \log_{10}\left(\frac{D}{d}\right)} \text{ watts} \quad (11)$$

Nomenclature

- A = Surface area of wire or its covering, if any, square inches = 3.1416 DL
- a = Absorptivity of wire or covering, if any, for solar radiation.
- D = Outside diameter of wire or covering, inches.
- d = Inside diameter of wire covering, inches.
- e_1 = Emissivity of wire or covering.
- e_2 = Emissivity of earth or adjacent objects.
- F_e = Fraction of total radiation directed toward the earth from wire.
- F_s = Fraction of total radiation directed toward the sky from wire.
- L = Length of wire of area = A, inches.
- P = Atmospheric pressure, atmospheres.
- R = Resistance of wire of length = L, ohms.
- r = Thermal resistivity of wire covering.
- S = Solar constant under prevailing conditions of time of day, time of year, latitude, elevation and atmospheric conditions, watts per square inch.
- T_a = Average temperature of surface of wire or covering, if any, and ambient air, $= \frac{T_1 + T_a}{2}$, degrees Kelvin.
- T_r = Temperature rise of wire, or covering, if any, above ambient air = $T_1 - T_a$, degrees Kelvin (also Centigrade).
- T_a = Temperature of ambient air, deg. K.
- T_1 = Temperature of wire or covering, if any, deg. K.
- T_2 = Temperature of earth surface or adjacent objects, deg. K.
- t_d = Temperature drop through wire covering, deg C.
- V = Velocity of air movement, fee per sec.

Factor Values

Recommended values of the factors involved in the above formulas are given below. These values are the result of a careful study of all of the available information and it is believed that they will give results as close to accuracy as is possible with

present knowledge of these factors.

1. Absorptivity for solar radiation—a.

Oxidized copper	0.85
Polished copper	0.50
Weathered aluminum	0.60
Galvanizing—new	0.65
Galvanizing—weathered	0.75
Galvanizing—very dirty	0.91
Weatherproof covering	0.90

The above values were obtained from various sources, including: Kent's Mechanical Engineers' Handbook; U. S. Bureau of Stds. Bull. V. 7 and V. 9.; Proc. Phys. Society (London) V. 43.

2. Solar radiation constant—S.
(Derived from data in Tech. Paper No. 128, Bur. of Stds.) at latitude of Washington, D. C. on clear day at noon.
S in midsummer = 0.612 watts/ in.^{2}
S in midwinter = 0.383 watts/ in.^{2}

3. Emissivities—e.

Material	Value of e When Material Is		
	Highly Polished	Moderate Oxidized	Badly Oxidized
Copper	0.04	0.55	0.75
Aluminum	0.04	0.10	0.20
Zinc	0.04	0.23	0.23
Non-metallic all kinds	varies from 0.85 to 0.95 use e = 0.90		

The above values were obtained from various sources, including: Kent's Mechanical Engineers' Handbook; McAdams, "Heat Transmission" (McGraw-Hill Book Co., 1942).

4. Fractions of total radiation to earth, sky, etc., F_e and F_s. $F_e + F_s = 1.00$
For a round wire in the open with no objects higher than the wire, $F_e = 0.50$, $F_s = 0.50$
(Based on personal communication from Prof. W. J. Wohlenberg.)
If close objects such as buildings are higher than the wires the value of F_e should be increased somewhat.

5. Thermal resistivity of weatherproof covering, r. $r = 500$. (IPCEA value)

Note that all of the I^2R loss is transmitted through the covering.

The current-carrying capacity table has been calculated by the use of the formulas given above. It is designed to cover normal operating conditions and not emergency overload conditions. No attempt has been made to set up ratings for emergency conditions because there is such a wide variety of loadings and durations that a single table would be extremely limited in its application. It would be better for the reader to calculate his own ratings for particular situations after deciding upon the limiting temperatures. This table has been based upon earth temperatures of 4 deg. C. in the winter and 50 deg. C. in the summer. The wind velocity has been assumed at 1 ft. per second crosswise of the wire. Conductor and air temperatures are given in the table.

Wartime Current Ratings of Bare and Weatherproof Covered Copper Wires and Cables in Normal Operation. Current in Amperes

Wire Size A. W. G. or Cir. Mil.		Bare		Weatherproof	
		Summer	Winter	Summer	Winter
Solid	8	74	100	84	119
	6	99	135	110	160
	4	131	179	146	208
	2	176	242	189	269
Stranded	2	181	248	199	283
	1	215	297	237	338
	0	242	336	267	381
	00	282	391	308	439
	000	329	457	359	513
	0000	380	528	418	596
	250,000	423	591	468	683
	300,000	475	665	522	747
	350,000	525	737	582	830
	400,000	572	803	634	907
	500,000	658	926	734	1050

Table based on air temperatures 60 deg. F. (16 deg. C.) in winter and 110 deg. F. (43 deg. C.) in summer.
Maximum copper temperature 80 deg. C. and maximum temperature of braid surface 70 deg. C.
Do not use *winter* values if there is any possibility of the air temperature being above 60 deg. F. at time of maximum load.

References

[1] W. H. McAdams, "Heat Transmission." McGraw-Hill Book Co., Inc., 1942.
[2] C. W. Rice, International Critical Tables. Vol. V., p. 234. McGraw-Hill Book Co., Inc., 1929.
[3] H. C. Hottel, Second World Power Conference. Vol. 18, Sec. 32, No. 243, 1930.
[4] H. J. Stoever, "Applied Heat Transmission," McGraw-Hill Book Co., Inc.

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Linemen Cautioned About Disengaging Radiosondes

The U. S. Weather Bureau reports that a fatal accident occurred recently when a lineman attempted to disengage one of the bureau's radiosonde balloons from high-tension wires in which it had been entangled in flight. The editors have been asked by the Weather Bureau to publish a description of the accident as a future safeguard against the risk that proved fatal in this case.

The radiosonde consists of a silvered cardboard box 9 in. square and 4 in. deep, containing apparatus for the automatic radio-transmission of atmospheric pressure, temperature and humidity. Attached to 6-ft. helium-filled balloons, these instruments are released for flight into the upper atmosphere twice a day from about 40 stations located throughout the United States. During flight the radio transmits a continuous record of the temperatures, humidities and pressures of the air through which the instrument passes, and the signals, recorded by ground receivers, provide the weather forecaster with very valuable information upon the structure and movements of upper-air currents to heights frequently exceeding 10 miles. At these altitudes the balloon bursts and the instrument returns to earth by parachute.

The radiosonde carries an antenna of No. 18 stranded rubber-covered wire extending 3 ft. above and below the box. The upper portion is held fairly straight by the pull of the balloon cord to which it is attached; the lower portion, bearing a light lead anchor, swings somewhat in the wind. In the accident reported by the Weather Bureau, the balloon became entangled in the wires a few feet from the crossarms of a high-tension pole, leaving the radiosonde box swinging free. When the lineman climbed the pole to free the balloon he apparently touched the lower portion of the antenna while the upper portion was in contact with the power line, and at the same moment his foot touched a piece of pipe attached to the pole, completing the contact with the ground.

UPPER-AIR automatic weather reporter caused fatality when lineman attempted to remove it from high-voltage circuit

Mechanical-Electrical Design of Power Plants Co-ordinated

Zones of responsibility set up for mechanical and electrical designers — Prospective superintendence staff participates — Co-ordinators compose various viewpoints — Auxiliaries the widest area of co-ordination — Manufacturers actively consulted

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CO-ORDINATION of the activities of mechanical and electrical engineers is a primary consideration in the power plant engineering field for two principal reasons: First, the opportunities for co-operative effort have full scope in that field and, secondly, the complex nature of this work requires well-organized procedure.

There are different opinions concerning the exact location of the dividing line between the two fields of activity. Merely to mark a transition in responsibility, the traditional coupling between the driving and driven machines serves as a rough sort of guide, remembering, of course, there are a number of couplings in many parts of the plant. Actually, however, neither the coupling nor any other fixed point can be set up as an arbitrary point of division. Neither branch is in position to proceed indefinitely without the assistance of the other; thus there are many opportunities to merge viewpoints, knowledge and experience of both. This tendency to merge makes it necessary to establish definite zones of responsibility and adequate procedures in order that this co-operative effort may be carried to a co-ordinated conclusion.

Objectives of Co-ordination

Let us assume that we have for execution a major total project and that the technical force available consists of a division of mechanical engineers (which includes structural, architectural and industrial engineers) and a division of electrical engineers under the guidance of the company's mechanical engineer and electrical engineer respectively. Further, that both branches are organized and manned adequately for the problem at hand and that the viewpoints of both groups are crystallized in the philosophy just discussed. It is necessary, of course, that these divisions function together so that all parts of the project are designed with proper regard to each other part, that the sequence of operations is such that progress may be made in logical step by step fashion, that duplication of effort is avoided, that no part of the work remains undone or is delayed due to misunderstanding; in short, that the basic plans are executed economically and expeditiously and that the final result is a complete realization of these plans. The specific manner in which these objectives are achieved in actual operation naturally will vary considerably with circumstances, but satisfactory results may be realized in many ways.

Co-operative Spirit Essential

Organizational features naturally have an effect on the development and application of the co-operative spirit. The ideal environment is one of unity and action. These are realized to a great extent in the organization with which the authors are associated because all production, including both operating and engineering, is under the same ultimate supervision, promoting a unified and active atmosphere of co-operation throughout the organization. The plant superintendent is appointed almost at the inception of the new project. This man usually is detached from his previous responsibilities and for a great many months his entire time is spent in contact with the mechanical and electrical engineering groups who are engaged in preliminary design work. This procedure not only serves to promote co-operative action between the two branches of engineering, but also when the superintendent takes up his duties in the plant he is familiar with all of its design features and the reasons for them.

Preliminary Layout

As the project progresses the initial appointment of a superintendent is supplemented by the appointment of others of the operating personnel, so that when construction is completed there is available at least a nucleus of a well-informed operating force to take over the new project. The maintenance forces and the power plant chemists, who must be consulted from time to time, are a part of the operating organization. In other projects, involving additions, improvements or changes to existing plants, the operating personnel is constantly in touch with the design work.

In practical operation, one of the first co-operative steps in a major project is the development of key plans and sections of the plant. A number of preliminary layouts must, of course, be made, and these will incorporate, as they progress, a digest of ideas of the electrical, mechanical and operating engineers. In making comparative studies to determine the

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number of units to be installed, the optimum operating conditions for the plant, etc., these plans will be utilized to determine costs essential to the comparisons.

Basic decisions may then be made covering the important fundamentals of size and location, number of units, pressure, temperature, voltage, type of auxiliary drive and other major features. Thus we arrive at the point where the mechanical and electrical engineers, together with the operating forces, all working under their usual supervision, concern themselves with the active consideration of executing the job. We may now explore in somewhat greater detail the method by which effective procedure is realized.

Project Engineers Co-ordinators

Since co-ordination is a paramount issue, it follows naturally that there should be a project engineer in each of the two divisions who is designated to act as a "co-ordinator" of the detail design of the project. Obviously also there are in both divisions a number of specialists who are involved in this co-ordination and whose services and advice are invaluable in connection with any particular technical point that may arise. The co-ordinators need not be in contact continuously with all of the detailed activity of these specialists, but there will always come a time when the results of the considerations of the electrical specialists must be merged definitely with the results of similar studies made by the mechanical specialists.

It is the duty of the co-ordinators, still operating under the electrical engineer or the mechanical engineer and their usual organizational supervision, to see that this amalgamation of ideas occurs at the proper time and that no important consideration has been neglected, to obtain decisions and transmit information concerning them promptly and adequately to the construction organization, which will proceed on the basis of these decisions. Scheduled conferences of key men from the mechanical, electrical and construction groups provide a definite opportunity for periodic contact of those responsible for co-ordination.

The key plans and sections may now be developed in their final form. The co-ordinators are responsible for the inclusion of all decisions concerning number of pieces of equipment, their size, location and other pertinent information on these key drawings, which serve as a guide for the designers and layout men of all groups, including the construction forces, and as a basis for future detailed discussions.

Auxiliaries' Motor List

In many cases the design of the station auxiliary system provides the widest possible field for the co-ordinating activity. The problems of size, voltage, method of starting, dual drives, and the utilization of steam drives, where they are adaptable, offer a great variety of problems which require the closest possible contact and unified effort by the engineers who know the mechanical part of the job and the engineers who know the electrical part. Aside from the purely technical considerations, such other engineering items as first cost, adaptation to the heat balance scheme and station economy must be thoroughly studied in order that the best final design may be realized.

Following approval of the up-to-date key drawings, the mechanical engineers are in a position to develop an approximate plant motor list which will include number, size and location of all motors in the plant. This information is essential to the electrical engineers so that they may proceed with selection of voltage for auxiliary drives, determine capacities of proposed transformer banks, permit design of bus arrangements and provide services to the proper locations. A similar procedure to that outlined for key drawings and the motor list is followed in preparation of lists of control systems, control boards, instruments, operating alarms, etc.

It might be stressed that the co-ordinating engineers should expend every effort to keep the key drawings and the above equipment lists up to date with proper approvals. In so doing they expedite and facilitate development of details and place in the hands of the designing engineers the proper tools for intelligent across-the-table discussions. Frequent revisions not only keep all concerned abreast of the job but they eliminate much internal correspondence.

Some of the most interesting and difficult problems in plant design are concerned with bringing to a co-ordinated conclusion the viewpoints of the manufacturers, operating personnel, construction forces and the mechanical and electrical engineers. One outstanding example of this occurred recently. The question of reliability and self-sufficiency of a projected plant arose. The most attractive installation proved to be one utilizing a so-called house turbo-generator. This machine would carry practically all of the essential turbine and boiler auxiliaries operating in conjunction with suitable transformer capacity.

House Generator Capacity

Many problems arose, among which was the optimum capacity of this generator. A number of the motors driven from it were of quite large capacity and difficulty was anticipated in starting these motors at full voltage. The actual capacity needed for the driven auxiliaries was determined by the mechanical engineers from their knowledge of the power requirements of individual pieces of auxiliary equipment. The added capacity necessary in the generator to perform the starting operation without undue voltage drop became a problem for the electrical engineers, and this, in turn, had to be referred to the manufacturers, not only from the standpoint of procuring a machine of practicable and standard size, but to be certain that the normal load-carrying function was properly correlated with the occasional starting duty to be performed. A mass of incidental detail was involved in these studies requiring joint review at many steps in order that every important consideration, either mechanical or electrical, was included. It was necessary also to bring the several alternate schemes to nearly the same advanced stage before they could be abandoned in favor of the plan adopted. Finally, it was necessary to prepare a joint report.

It would have been impossible to reach a suitable conclusion on this problem without the assistance of the turbo-generator manufacturer. Not only was it necessary to get considerable information from him in order to study various alternate propositions which were surveyed, but also his experiences with the same problem on

other properties was of great value. In this case, of course, the same manufacturer was interested in the driving and driven machines. Other and different problems arise when two manufacturers merge at the coupling, as discussed later.

Control, Motor Details

Another major plant item which requires very close co-ordination of effort between the electrical and mechanical engineers and the manufacturer is the control apparatus, which is becoming more and more important with large capacity boilers and other units in present-day plants. While all controls are not necessarily operated electrically, these types must be compared with those employing mechanical media, particularly from the standpoint of plant economy and plant reliability. The problems of control, interlocking and operating sequence are particularly good examples of the kind of problems which can be covered advantageously in across-the-table discussion.

In many cases operating experience dictates that the manufacturer should consider changes in his standard practice. In a particular case a motor bearing of a certain type had failed in one of our plants, and from comparison with motors performing similar services in other plants it was found to be less reliable. The manufacturer of the driven equipment had previously discussed various types of bearings and his decision had been to standardize on the type that had failed in service with us. It was found necessary to call a conference, which included representatives of the motor manufacturer and the manufacturer of the driven equipment, members of our operating personnel and of our mechanical engineering and electrical engineering divisions. In this meeting both manufacturers' thoughts on design requirements and operating and engineering experience from our company's personnel were thoroughly exchanged. The result of this meeting was a design mutually satisfactory to the two equipment manufacturers and the users.

Questions of building design, architectural treatment, lighting and ventilation are usually in the sphere of the mechanical engineering division, yet very close co-operation is required in order that proper space may be provided for the various electrical bays considering handling facilities, space for maintenance and other similar considerations. The problem traverses a full circumference with respect to lighting where the mechanical engineer is responsible primarily, yet the facilities must be designed and provided by the electrical engineer due to his familiarity with lighting technique, but finally the mechanical engineer must provide for the lighting facilities, furnished by the electrical engineer, based on his own general specification.

The co-ordination that is necessary in order to realize orderly procedure does not come about automatically. To secure the desired reliability, economy and speed in co-ordination it is necessary to reduce it to a system which will guide the movements of the various participants. Inevitably this will involve the use of certain standard forms for the accurate transmission of data among the groups. For example, in applying a motor to a pump, the first operation usually is for the mechanical division to purchase the pump. The mechanical engineer knows from negotiations with the manufacturers the horsepower required by the pump at various speeds, the size of the coupling to which the motor must be attached, and other necessary details. This information is compiled by the mechanical division on a form which is provided for that purpose, listing all the information necessary to purchase the motor. Transmittal of the completed form marks a recognizable transition in responsibility.

In many other phases of these activities it has been found necessary to use definite procedures in order that transitions in responsibility may be definite and obvious. However, to repeat, the use of any particular system, no matter how carefully devised, will not supersede the proper mental attitude. The desire for co-ordination is a great deal more important than the specific manner in which this co-ordination occurs. Further, the point which marks the transition in responsibility is not a barrier to further co-operative effort.

Influence of War Factors

Unusual conditions and restrictions of war-time have had considerable effect on the flexibility of our design work. This has led to a new point of contact between the electrical and mechanical groups because it is found necessary to substitute less critical material for the ideal material which would have been used in the absence of restrictions. The necessity for designing on the basis of utilizing available material has brought about a myriad of problems requiring co-ordinated effort. Another example of co-ordination which is an outgrowth of war conditions is that in arranging stations and substations for blackouts it is often found that ventilation is affected, and it is necessary for the two groups to co-ordinate so that blackout regulations may be followed without interfering too seriously with the ventilation system.

While emphasis in this paper has been on power plant work, co-ordination is in effect also in connection with substation design, steam distribution systems, company office and service buildings and in many other categories where there is a common interest and responsibility between mechanical and electrical considerations.

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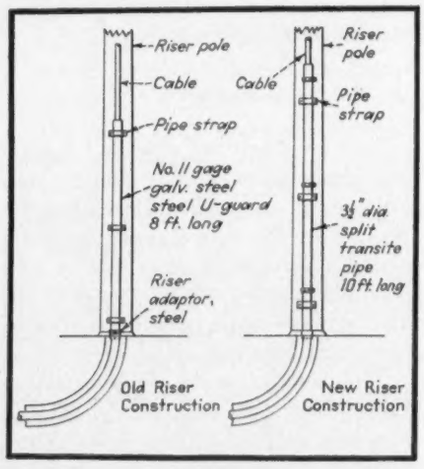
Substitute Riser Cable U-Guards



A split 3½-in. transite conduit is being substituted for the old standard steel U-guard and the riser casting is being omitted on most of the riser jobs of the Wisconsin Electric Power Company for the duration of the war. This change results in a saving of 10 lb. of steel and 2 lb. of cast iron on each riser. A sketch of the old and new type riser installation is shown.

Children's Contest Spreads Appliance Conservation Story

Milwaukee utility carries appliance conservation story into every home with simple "check the answer" contest for school children — Activity correlates company's wartime service, advertising and conservation efforts

LIKE the proverbial "fool and his money," the careless housewife and her appliances are soon parted. Yet today more blame attaches to the thoughtless home maker than to her dull-witted brother. For in times like the present she cannot replace what she wastes, nor can she take refuge in ignorance.

Because today over the country the electrical industry is geared to helping Mrs. America take care of her priceless appliances. Repair activities have been stepped up, newspaper advertising has been geared to the problem, utility home economists are lecturing about it and countless articles have been written in women's magazines and elsewhere.

Approach

An as yet untried approach to the problem, however, has come from Milwaukee, where last December the Wisconsin Electric Power Company closed a three-week activity that successfully carried the story of appliance conservation into the homes of customers through the children.

This activity, under the auspices of Reddy Kilowatt, took the form of a widely advertised contest for boys and girls in public, private and parochial schools whose parents or guardians were customers of the company.

Children were asked simply to read a page of instructions on how to use electricity efficiently and make appliances last longer. Then on a prepared blank they were asked to check the three most important of several suggestions for the care of each of thirteen commonly used appliances and indicate the number of wrong ways

MECHANICAL JUDGE—Quick "screening" of daily entries was done with this device, using light to spot correct answers

of handling and using appliances they could find in a picture full of "boners." It was suggested that the children have their parents help them in filling out the blank. Ninety prizes were offered to the winners, ranging from a $100 war bond to $1 in war stamps.

Objectives Achieved

The activity achieved at least four objectives that are related directly to the company's wartime service program:

1. It afforded a practical advertising vehicle in lieu of no regular schedule of merchandise and electrical promotion advertising.

2. It stimulated continued interest in the uses of electricity in homes and emphasized the important role electricity plays in the home under wartime conditions.

3. It tied in with the war effort by emphasizing conservation of critical war materials through careful use of electric appliances, thereby prolonging their life and usefulness.

4. It provided a logical follow-up to the company's previous advertising, in which electricity and its uses were closely identified with the war effort.

Response

Proof of the success of the contest lies in the "postmortem" statistics of the activity. A total of 234,723 contest folders containing "an important message for boys and girls . . . " were mailed to the homes of all residential and rural electric service customers. Out of these 14,704 were returned filled out as entries in the contest, although 81 of these were late and therefore disqualified. Total over-all cost of the contest was $12,646.71, or $0.858 per contest entry. It is, however, patently unfair to charge off the entire cost to entries received, since there can be no doubt that the message of the folder was absorbed by many who did not enter the contest.

Equally satisfying was the spontaneous response of letters. They came from parents commending the company for disseminating helpful and useful information contained in the contest folder. Children themselves wrote in to describe the fun they had in submitting entries and to pledge their help in conserving appliances in their homes. Teachers in Milwaukee schools requested additional contest folders to be used in "class projects." Nearly 1,000 extra folders were requested for this purpose.

The conservation theme of the contest was the topic of conversation in several women's group gatherings. Furthermore, the contest prompted

many intimate customer contacts that might not otherwise have been established. These contacts were via phone calls, personal visits and letters accompanying entries.

Cost

Here are cost items in the execution of the contest; radio time costs are not shown, since time already contracted for in the company's advertising set up for 1942 was used:

1. Contest folder—240,000 in litho offset	$3,572.84
2. Mailing envelopes, addressing, sorting and postage for 234,723 mailed	3,590.23
3. Newspaper advertising space	4,499.19
4. Newspaper advertising mechanics	509.45
5. Prizes—War bonds and stamps	406.25
6. Letters to prize winners by registered mail, including multigraphing	17.75
Total cost	$12,649.71

Contest Advertising

Direct mail, newspaper and radio advertising channels were used in attracting attention to the contest and announcing the winners. Direct mail was used to distribute the contest folders, containing complete contest information, to residential and rural electric service customers. The mailing envelopes carried a message stating that contents contained an "important message for boys and girls."

Newspaper advertisements were run preceding the contest by a few weeks and weekly during the contest period in three Milwaukee metropolitan dailies and one Racine daily, 24 suburban and country weeklies, one Racine weekly and eight foreign language and class papers. An advertisement after the close of the contest announcing the winners was run in four metropolitan dailies in Milwaukee and Racine. A total of 4,146 column inches of advertising was run.

Radio featured the contest once a week on the company's regular triweekly Kilowatt-Hour radio programs over station WTMJ and in spot announcements over stations WISN and WEMP.

Judging of Entries

Final judges of the contest were the secretary of the Wisconsin Utilities Association, an advertising agency executive and a company sales department division head. The company's own advertising manager "sat in."

To determine which of the several suggestions listed under each of the thirteen appliance items on the entry blank could be regarded as the "three most important," contest folders were given to local representatives of electric appliance manufacturers and distributors, company appliance service and repair men, members of the sales and advertising departments, company executives and others, with the request that they each check their opinions. These findings were tabulated and compared. Final composite findings were adopted as correct answers.

Wrong ways in the picture were largely predetermined in giving instructions to the artist who made the illustration. These errors were thirty-five in number and were listed, checked and rechecked on the "pencil rough" before final ink drawing was made.

Entries were judged daily as received. Those with seven or more suggestion errors were immediately thrown out as first eliminations. A final lot of 300 entries remained for the judges to handle, and from them the 90 prize winners were selected.

Generally speaking, the number of suggestion errors was the deciding factor in selecting the winners. Wrong ways in the picture, intended as an "out" in case of ties, did not (except in a very few cases) count to the extent expected. It was well, however, to have this "out" feature included.

"Ties" No Problem

No difficulty was experienced on "ties." Only one entry was "perfect" both as to suggestions checked and wrong ways indicated. It was awarded first prize. Two entries had only three suggestion errors and were awarded the two second prizes. Three entries had only four suggestion errors and were awarded the three third prizes. The next ten prizes were awarded to entries having only five suggestion errors and so on.

Mechanical "Judge"

A unique mechanical device, shown, served to expedite the daily elimination process. The device used light to spot the correct answers. A thin plate was drilled with a small hole for each correct answer and this plate mounted on the edge of a desk as shown with a reflector lamp on the floor below it. The operator, placing each sheet on the plate in turn, saw each of the correct answers illuminated with a spot of light from below and could easily note whether or not the right squares had been checked.

Fluorescent Lamp Outlets in Service

A. B. ODAY
Executive Engineer,
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Since April 21, 1938, when the fluorescent lamp was first made commercially available, reports have appeared each year giving the approximate total number of lamps that have been sold.

The first year or two it was easy to estimate what percentage of total lamp sales went into new installations and what percentage was used for renewal purposes. For the past three years there has been much discussion and a great variety of estimates made as to the quantity of new outlets that have been added each year. In order to arrive at a fairly accurate basis for evaluating the place of fluorescent lighting in the lighting field, an investigation was recently conducted to determine the numbers of permanent lamp outlets that had been added each year since the fluorescent lamp was introduced, with the following results:

Year	Estimated Number of Permanent Lamp Outlets Added Each Year
1938	*50,000
1939	1,600,000
1940	5,750,000
1941	14,500,000
1942	9,000,000
Total number of standard fluorescent lamp outlets installed as of December 31, 1942	30,900,000

It will be noted that for the year 1938 only 50,000 permanent lamp outlets have been retained. While a greater number than this was sold during that year—perhaps 150,000—however, many were for temporary lighting at both the New York and San Francisco fairs. In arriving at the values quoted in the table such factors were taken into account as lamp sales, lamp renewal sales based upon installation surveys, sales of lampholders, sales of starter receptacles and last and probably the most accurate guide, the sales of lamp ballast analyzed and broken down on the basis of single lamp and two, three and four-lamp types.

By checking and cross-checking the various values it is felt that the figure of 31,000,000 represents in round numbers a fairly accurate estimate of the total fluorescent lamp outlets in service as of December 31, 1942.

*Net remaining permanently in service.

PRIORITIES PROBLEMS

Effect of U-1 Changes on Special Exemptions

Case No. 56

The change from P-46 to U-1 as the basic order regulating electric utilities brought a change in the standards on which inventory and withdrawal bases are calculated. From one utility, which had petitioned successfully for an increase in the withdrawal and inventory bases for switching and substation materials established under P-46 came a query as to the status of its increased bases under order U-1. Specifically, the company wanted to know whether it could continue to use the increased bases or whether it was necessary to resubmit its request.

The answer was that if U-1 provides greater restrictions on allowable inventory or withdrawals in the specific control class than did P-46 the request for an increase must be resubmitted for review. If the U-1 restrictions in the specific control class are less rigid than those of P-46 (October 10 version) the request did not have to be resubmitted.

An example of the point is the following: Suppose that under the October 10 version of P-46 a company has a quarterly withdrawal base for switching and substation work of $2,000. The company determined that this amount was insufficient and petitioned for an increase to $3,000 per quarter. Its petition was granted.

Under U-1, with withdrawal bases computed on the basis of withdrawals during the last nine months of 1942, the company's allowable base was raised from $2,000 to $2,500. This is a relaxation of the P-46 base, and as a result the company may continue to use its specific authorization to exceed the standard base. Had the recalculation under U-1 resulted in a base lower than the allowed $2,000 a resubmission would have been required.

In such a case, in line with the reduction dictated by U-1, the authorization to exceed probably would be cut proportionately.

Accepting Late Deliveries

Case No. 57

Indicative of OWU's desire to work with utilities on a simple, common-sense basis wherever "act-of-God" problems not specifically provided for in Order U-1 arise is the case of a company which asked what it should do in the following situation:

Material which had been scheduled for delivery in the first quarter through no fault of the purchaser was delivered during the second quarter. Acceptance of the delayed delivery, under a strict interpretation of paragraph F-2, would have put the purchaser over his second-quarter quota or would have caused him to cancel already-scheduled second-quarter deliveries to make room for the late order.

The company was instructed to accept the delayed delivery and, in recording the shipment, to include a notation of the reason why it is in excess of its second-quarter quota. This same reasoning would apply to those cases in which deliveries scheduled for the third quarter were actually made in the second quarter. In either case the rigid provisions of paragraph F-2 would not control, but rather a reasonable, matter-of-fact attitude on the exigencies of a wartime economy would be the standard.

Keynote for this attitude is to be found in CMP Regulation No. 1, which provides that a producer of controlled materials may ship 30 days late or 15 days early and still be regarded as having met his quarterly delivery schedule. Conversely, under CMP No. 1, a purchaser of controlled materials may accept delivery 30 days late and 15 days early and charge it to the quarter in which delivery was scheduled. Here again, however, OWU suggests that a notation be made on the records showing that the delivery was scheduled for a given date and that its arrival before or after that date was due to the seller, not the buyer.

Salvage Reduces Project Cost

Case No. 58

The AA-1 rating which order U-1 makes automatically available for maintenance, repair and operational purchases may be used for projects of considerable size, provided their net material costs remain within the $500 overhead or $1,500 underground cost limitations. An example of this point is to be found in the query submitted to OWU by a small utility which wanted to know whether the AA-1 rating was permissible in the following instance:

A line of some length was in such weakened shape that replacement was necessary. It was proposed that the replacement include rerouting, which would not only give better service but also would shorten the distance by about three miles. Due to geographical conditions, however, the rerouted line required stronger conductor than that in the existing line, most of which could be salvaged for return to inventory.

OWU ruled that because the value

RIT IS DESIRABLE, in order to assure deliveries, that utilities which during the first quarter of 1943 scheduled second and succeeding quarter maintenance, repair and operational purchases under Order P-46 should rerate them, using the MRO-U allotment symbol for controlled materials and the preference rating AA-1 for other items assigned by Order U-1. It is not required that such orders be rerated but if this is not done deliveries will be less certain under the AA-2X and AA-5 ratings awarded by P-46. Since Order U-1 curtailed the base upon which allowable quarterly quotas for maintenance, repair and operational equipment may be calculated, some producers who ordered in advance under Order P-46 will find themselves with scheduled second-quarter, or later, deliveries in excess of their allowable Order U-1 quotas. If they choose to rerate their orders to take advantage of the higher ratings offered by Order U-1, such purchasers must decide which orders shall be canceled or deferred until a later quarter and which shall be met in the second quarter.

the salvage cut the net material t for the rerouted line to a sum exceeding $500 the project would considered as maintenance, repair l operations and, thus, the AA-1 ing could be applied to purchase the heavier wire. The ruling was conformity with paragraph B-1, ich assigns the automatic rating AA-1 for such orders.

Had the salvage value of the lighter re been insufficient to reduce the t value of the project to $500, the oject would have been classified as major addition to capital and a ecial rating for it would have been quired.

Ordering Early Under Inventory Redistribution

Case No. 59

The Office of War Utilities con-ders that once a purchase order for n item in the excess inventory of a tility has been accepted the sale is onsummated and that delivery of he item may legally be deferred until future date specified by the buyer. This was the ruling in the case of utility which found it necessary be-ause of a delivery lag to place an rder for several distribution trans-formers for use in a quarter subse-uent to that in which the order was o be placed. Inasmuch as distribu-ion transformers are included in Schedule C, thus subject to the pro-visions of Order U-1's inventory re-distribution program, the company pplied to its regional office for the equipment, which was located in the excess stocks of another utility in the region.

The prospective purchaser was un-able to take immediate delivery of he transformers without exceeding its quarterly quota for deliveries, but was reluctant to allow its order to await the arrival of the quarter in which it planned to use the trans-formers for fear they would have been purchased in the meantime.

OWU ruled that the prospective seller could accept the order for de-livery on a specified date during the quarter when the buyer wanted to use them. No money was required to change hands to bind the option which the buyer thus obtained on the equipment. And inasmuch as no de-livery was made until the subsequent quarter, the buyer was not in viola-tion of the provision restricting quarterly deliveries.

In the event that the seller refuses to keep the wanted item in inventory pending subsequent delivery date, the purchaser may accept delivery and, in entering the delivery upon his rec-ords, make a notation of the reason why he exceeded his allowable quar-terly quota in doing so.

Of course, the purchaser's quota for the quarter in which it is planned to use the excess delivery must be re-duced sufficiently to accommodate the unbalance created by accepting the early delivery.

GONE FROM Utilities Order U-1, in the amendments of April 17, is the provision requiring that utilities obtain at least 50 percent of their wire, cable and bus bar requirements for repair, maintenance and operations from the "surplus" stocks of other utilities. Since the inventory redistribution program outlined in Paragraph J of the order became effective on April 1, utilities must attempt to obtain all their requirements of wire and of a number of other commonly used materials through the Office of War Utilities' regional offices before placing a purchase order with suppliers. Hence, there is no longer any need for utilities to "keep books" on the proportion of wire obtained from other companies and from suppliers.

P-19—U-1 Interchange

Case No. 60

Normally, the matter of keeping records on all shifts and changes in inventory is one to which utilities must render diligent attention under Order U-1. There are cases, however, in which it is permissible to relax the rigid bookkeeping practices.

One of these was brought up when a utility inquired of OWU whether it could apply inventory obtained under U-1 to a construction job rated under Order P-19. Material had been ordered on the P-19 rating, but had not arrived. Its absence threatened a hold-up on the job, but the utility had on its shelves maintenance, re-pair and operational stocks sufficient to do the job. The company wanted to know whether it could use these MRO stocks and replace them when the late materials ordered under the P-19 rating were delivered. If this were allowable, the company in-quired, what was the bookkeeping practice to follow.

The answer was that the MRO ma-terials could be used to complete the construction job and that the delayed materials could be returned to in-ventory to replace the diverted MRO goods. Bookkeeping was to be offi-cially nonexistent. The withdrawal from working inventory was to be excluded from the withdrawal record, and the replacement was also to be made without insertion on the de-livery records.

Additional Farmstead Wiring

Case No. 61

Order P-144 (ELECTRICAL WORLD, April 24, page 15) establishes the pro-cedure and an automatic AA-3 pri-ority rating by which farmers eli-gible for electrical service under Utilities Order U-1-c may obtain the necessary materials and equipment to wire their premises. Not covered by this order, however, are farmers who have had service since before the war and who find now that they need a third wire or an extension of their lines to an additional building.

A typical instance involves a farmer who needed several hundred feet of wire to connect a new chicken house but found that he wasn't eligi-ble to the P-144 procedures because he has had service for several years. The utility, asked for aid, turned to the Office of War Utilities. Result of this and similar inquiries has been the establishment of a special pro-cedure.

The farmer first applies to his county war board for certification of his need for the additional wire for food production operations. He then fills out Form PD-200-c and sends this, with the board's certification, to the OWU's regional office, which will assign a rating. No automatic rating is provided as in the case of new farmstead wiring jobs under P-144, but the regional offices are instructed to assign ratings sufficiently high to get the needed materials. At the same time, the farmer is given a release from the terms of Order L-41, the War Production Board's order gov-erning all new construction.

Editorials

S. B. WILLIAMS, Editor

Relation of Coal Supply to "Brownout"

THE much-discussed "brownout" apparently is scheduled to go into effect in the next six or seven weeks, but it will be inaugurated this time not by OWU, but by WPB. In other words, this is a conservation measure to save coal transportation and some other things thrown in for good measure.

That, however, doesn't change the fact one iota that the immediate saving will be in electricity and that the utilities are the ones that will have to make it work. That is implied in the assumption that the order will be administered through OWU.

In many respects the order differs from the first proposed about six months ago. It recognizes the safety character of street lighting and leaves the determination of its operation to the local authorities. In view of the accident record of the dimout areas this is a sensible move.

Likewise, the order is to be nation-wide in its application and not regional, as was once discussed. That, too, seems logical in spite of the fact that certain areas are largely hydro-supplied or are close to fuel. Most of the hydros have steam reserve or feed a system that also has a steam component. And besides, if the measure is also to conserve on manpower and light bulbs, then the character of generation is of no consequence.

The transportation of fuel by utilities this year, even without this order, would be less than last year in spite of an increased fuel consumption. That seems not to have been taken into consideration.

In the first eight or nine months of 1942 the utilities were busily carrying out the suggestion of the Power Branch that a long supply of coal be laid in. It reached its peak in October and November, with 110 days supply. Since that time it has been allowed to fall back to 100 days.

If the industry were to do no more than is asked by Mr. Ickes, namely, stock a 90-day supply, it could further reduce its incoming supply. In any event all the demand that it will now place on the railroads will be for current needs, since it no longer has any stock piling to do. Therefore the statement by the Federal Power Commission that the industry will need an extra 10 million or more tons of bituminous coal this year is erroneous. As a matter of fact, it won't even consume that amount more because the commission apparently neglected to take into account the efficiency of the new units, or the generation from natural gas or oil. But even if that amount extra were consumed it would not represent extra haulage for reasons just explained.

Furthermore, if the brownout is going to save one to two million tons of coal there will be still less demand on the railroads by the utilities. Strangely enough, the amount by which the utilities are now stocked beyond what Mr. Ickes asks for is considerably greater than the amount of coal saving that Washington officials estimate will result in the first year of the brownout.

In other words, there is enough excess coal supply on hand to cover a year's brownout saving besides a reduced haulage requirement for stock piling. On that basis it is apparent that the utilities will contribute both coal and transportation to those other industries that did not store up coal a year ago when the situation was easier.

State Regulation Further Challenged

THE LABORED WAY in which the present Supreme Court goes out of its way to declare utility operations interstate was never more clearly evidenced than in the recent decision in the Jersey Central vs. Federal Power Commission case. A company which sold to another in the same state, but which, in turn, sold across state lines, was declared to be engaged in interstate operation in spite of the fact that it had absolutely no control over the energy once delivered to its customer within the state.

Although the law setting forth the powers of the commission especially denied jurisdiction to the commission when state regulatory authority existed, the court chose to disregard this injunction by the Congress as well as the discussion of intent at the passage of the act and to fasten on some minor construction for its interpretation.

One can understand the Federal Power Commission's desire for such liberal interpretations because it is handicapped in its regulation of interstate rates if it has limited authority over energy costs. That, however, is no judicial reason for declaring an innocent supplier to be an interstate operator.

If this decision is allowed to stand, one can only conclude that any company selling energy to another that sells across state lines or that is tied in with such another company, though its own deliveries all be intrastate, is nevertheless subject to the regulation of FPC.

This decision is clearly a challenge to state regulation of utilities. The language of the act put there for the sole purpose of protecting state authority from infringement by federal agencies has been brushed aside by the

majority opinion. Since it is doubtful that the present court would reverse itself, some way should be found for Congress to define with even more positive language the jurisdictional boundaries of the commission.

There can be no question about the need for federal regulation of interstate energy flow. It is the determination of interstate traffic and the role of state and federal regulation that needs clarifying.

What Is Service?

SERVICE EXTENSION, service connection, service head, public service companies, home service, service industry, service department—what do we mean by service?

"Service" is a good word and has a definite meaning, but it has been used so much in the utility industry to cover so many things that it is becoming somewhat confusing.

Everything the utility does is in some way related to the service of the customer. That is a power company's job. "Service," therefore, is an over-all word and covers all operations. Why should we detract from the comprehensive meaning of service by using it to label a repair or maintenance department or to give a name to that small operation of closing a switch?

The fundamental thing in this business of supplying power is the service of the customers—the unfailing, high quality service of the customer. It isn't just hooking up a meter, or calling on a housewife, or replacing a fuse. They are but parts of service.

If this larger meaning of service can replace all of our other uses of the word, so that we understand that service is basic in all of our efforts, many of the tasks in utility operation might take on a new meaning. And perhaps our over-all relations with the customers might improve.

What's in a word? It depends on how one uses it. We have used "service" to signify parts of the job, and in so doing have confused its use. Let's see it in its broader and more fundamental aspect.

Diesel Performance Data

WITH an absolute minimum of comment and no conclusions, but a profusion of data, the A.S.M.E. subcommittee on oil-engine power costs has released its report on 1941 operating experience. Whoever wants to see how diesels are performing can find it here, comprehensively, impartially and authoritatively. Data are given for 400 units totaling over 300,000 horsepower in 151 low-speed stationary plants that turned out half a billion kilowatt-hours. Not only are the data given in detail for 1941 but comparatively, in abstract, for each of the twelve years since the first report was issued.

Plotted data for lubricating oil economy are "all over the lot." There is considerable spread also in the fuel economy data, but points for 121 full-diesel plants do seem to bunch around 12 kw.-hr. per gallon of fuel oil for plant running capacity factors in the range from 60 to 80 percent. This is equally discernible in the chart for 235 individual engine-generators. Fuel oil costs congregate in the 4 to 6 mill per kw.-hr. region, with a few under 3 mills and one or two well above 10. Attendance runs from a few hundredths of a mill per kilowatt-hour up to very high figures that arise from low annual plant load factors.

Over-all costs per net kilowatt-hour seem to show many in the 6, 7 and 8 mill brackets and only one or two below 5 mills; 71 of 135 plants report over-all generation cost above 1 cent per net kilowatt-hour.

Unfortunately, the committee is still unable to include data for high-speed plants, the reason being that few "have kept accurate information on the various items necessary to determine accurate operating costs." Locomotive data are also missing this year.

Line Insulation and Line Voltage

IN THE EARLY DAYS of high-voltage transmission it used to be safe to judge a line's voltage by its length—one mile per kilovolt, our professors used to tell us. And more recently, one, by looking at a transmission line, counting the number of insulator units, estimating the conductor separation, would conclude that it must be a 66-kv., 132-kv. or 220-kv. line. Such simple rules, however, give way to pronounced departures as we progress more in the art. The current trend, for instance, is definitely to regard the 60-cycle voltage rating of the line as having relatively little bearing on the amount of insulation used, and to design instead for a predetermined goal of lightning performance.

It would be smarter, though of course much harder, to attempt to classify the line visually as a 60 percent, 80 percent, or 100 percent line, and this could only be in the light of the operating voltage, the probable frequency, duration and magnitude of strokes, the permissible frequency and duration of interruptions, the mid-span clearance, the footing resistance and the rate of fault clearing afforded by the protective scheme applied. Few of these are visible to the "curbstone guesser," but they were all contemplated by the designer of an up-to-date line. It is the inclusion and reconciliation of these factors that fixes the insulation of the line conductors and not, as in the early days, just the operating voltage.

In short, the criterion for amount of insulation is a matter of how much lightning there will be to contend with, how much play to let it have, how important the line and its load are, how much could justifiably be spent to thwart interruptions and—what is the operating voltage.

Washington Comment

By R. N. Larkin, Washington Staff

"Shadowy Lines" Between OCR and OWU

ONE of the principal complaints in the recent blast unloosed by the Senate's Truman committee against the management of the nation's war effort concerned the ill effects of the shadowy lines of authority between various war agencies, within and without WPB.

The complaint pointed up to perfection reaction to the recent establishment of the Office of Civilian Requirements, which replaces the Office of Civilian Supply as official spokesman for 120,000,000 stay-at-home Americans in this war. The directive from WPB Chairman Donald M. Nelson establishing OCR gives the new agency considerable authority in the field heretofore ruled by the power division of the Office of War Utilities.

Before delineating OCR's jurisdiction in the electric power field, it should be made clear that this overlapping of jurisdiction is not likely to result in any conflict between OCR and OWU. Under any logical operation of either agency, there can be no conflict without utter confusion. Electric power is just as vital to the war program as is steel; thus it qualifies as a war commodity outside the jurisdiction of OCR. On the other hand, it is an indispensable civilian commodity; thus eligible for some control by OCR.

No Easy Division

Jurisdiction of the electric power field, however, cannot be divided that simply. Unlike the steel ingot, which can be halved to provide shells and dishpans from the same unit, power cannot so simply be divided at the central station, with this kilowatt aimed at an arms plant and that diverted to light the home of the war worker. Any attempt at such separation obviously would pose problems practically impossible to solve, and efforts to enforce such separation would cause much harm to service to every consumer, civilian or military.

This, then, is the first and best reason why there can be no appreciable conflict between OCR and OWU. There are others. Arthur Whiteside, head of OCR (ELECTRICAL WORLD, April 24, 1943, page 6), will have his hands full solving the other civilian supply problems now on his doorstep without attempting to administer the electric power field of OWU. It is inconceivable that he could fail to welcome the fact that electric power, for civilians and the war alike, is already being handled in a manner which WPB Chairman Nelson considers highly satisfactory.

Both OCR and OWU people insist that there is neither the need nor the justification for inter-agency conflict over power supply. While the two agencies may base this conviction upon varying reasons, the conviction exists and apparently is sincere.

Overlapping of Authority

Most apparent of the shadowy lines of authority between OCR and OWU is contained in Section 5.04 of the OCR charter. This provides that Whiteside shall "analyze and review proposed orders and the administration of existing orders so as to assure that such orders give full consideration to civilian needs, and to recommend such changes as are considered necessary to provide adequate consumer goods and services." Allied with this is Section 9.02, which provides that Whiteside "shall have access to such records and information of the War Production Board as he may deem necessary for the performance of his duties . . ."

Taken literally, these mean that OCR must approve all forthcoming orders issued by OWU which affect civilian use of electricity. If a conflict arises which cannot be settled by the operating men in each division, such conflict would, theoretically, be settled by J. A. Krug, director of OWU; Whiteside and Chairman Nelson. The futility of such a development has already been pointed out.

Again taken literally, the foregoing provisions of the directive mean that OCR could requisition OWU's files on administration of Order U-1-b, which defines the conditions under which kitchen range service shall be available to the public. It will be remembered that Section 5.04 allows OCR to "review . . . the administration of existing orders. . . ." Having access to such files, OCR could, conceivably, take exception to the rigidity of OWU's enforcement. Here again would arise a conflict, which, if not settled at the bottom, would inevitably have to be settled at the top.

There are other shadowy lines of authority between OCR and OWU. One is contained in the provision that OCR shall "determine requirements for civilian goods and services . . ." As far as this is necessary in the matter of electric power, this has been the function of OWU.

War Plants and Homes

OCR also shall "determine the policies of WPB for rationing consumer goods and services, when necessary . . ." This will affect the forthcoming "brownout" order (ELECTRICAL WORLD, May 8, 1943, page 5), although OCS had its voice in the decision to institute the "brownout."

OCR "shall present the consolidated requirements for controlled materials needed in the production of consumer goods and services to the requirements committees of the appropriate Controlled Materials Divisions . . ." Taken literally, this would require OCR to provide the copper for distribution lines to homes, and OWU to provide the copper for lines to war plants.

"The lines of authority are confusing even on paper," the Truman committee commented regarding WPB's series of "czars." The lines of authority are just as confusing in the OCR-OWU situation, but, as pointed out, it isn't likely that there will be any such tussles between Whiteside and Krug as there have been between other war agency heads.

NEWS OF THE WEEK

"Don't Waste Electricity" New Theme for Utilities

Washington meeting of WPB officers and utility representatives recommends that operating companies urge customers to conserve electricity as a wartime measure

"Waste in war is a crime; don't waste electricity just because it isn't rationed." That slogan, or its equivalent, is recommended to all operating companies for inclusion in their advertising copy.

The action results from a suggestion by J. A. Krug, director of the WPB Office of War Utilities, that utilities eschew "promotional" advertising during the war. Wording of the slogan was worked out at a meeting arranged by President Tom P. Walker of the Council of Electric Operating Companies and attended, in addition, by C. W. Kellogg, president of Edison Electric Institute, Krug, and representatives of the industry and of OWU.

Promotion Implied

It was felt by the Office of War Utilities representatives that advertising asserting adequacy of power could not escape being of a promotional nature, than conservation of all kinds should be a necessity in wartime and that the utilities should urge their customers to avoid waste of electricity.

Suggestion was made that the slogan or its equivalent be inserted as a block in regular advertising or worked into the text as individual companies may prefer.

Attending the meeting in addition to Walker, Kellogg and Krug were Samuel Ferguson, Hartford Electric Light Co.; Ralph E. Moody, Union Electric Co.; C. A. Collier, Georgia Power Co.; Milton Sanders, Central Arizona Light & Power Co.; G. C. Neff, Wisconsin Power & Light Co.; Paul McKee, Pacific Power & Light Co., and J. G. Holtzclaw, Virginia Electric & Power Co., and these OWU officials: Edward Falck, deputy director; William A. Lyons, director of the fuel and allocations branch; Herbert S. Marks, general counsel, and Russell Hogin, public information.

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Critical Components Get Attention

Twenty-three critical common components, many of them used in power generation, will probably soon be scheduled under the proposed Component Scheduling Plan which is designed to cut down paper work and adjust imbalances.

Formal announcement of the plan, which will affect only the 23 specified components for use in the ship, power, rubber, high-octane gasoline, aluminum, magnesium and steel programs, may be expected at almost any time.

The new plan is aimed at seeing to it, for instance, that the power plant which needs turbo-blowers and certain valves to get into operation on schedule will get both types of components, in necessary quantities, on time. It is also designed to assure that the manufacturer of critical common components, who incorporates another critical component into his product, will get the sub-components in sufficient quantity and on time to meet scheduled delivery dates.

Claimant agencies, of which the Office of War Utilities is one, will submit their schedules of critical common components as far in advance as possible. WPB will then try to reconcile these requests with manufacturing capacity, diverting business from one manufacturer to another if necessary. Approved forms, showing component schedules for each claimant agency, will be returned to each agency to be passed on back to component makers as authorization to accept orders.

To buy sub-components for a critical common component the component manufacturer will submit a similar schedule to his suppliers with delivery dates based on the schedule given him by the claimant agency.

The new plan uses certain of the techniques of the Controlled Materials Plan to bring enough of the right components to the right place at the proper time.

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Government Wins Pitt River Case

The U. S. Supreme Court this week refused to hear the appeal of the Pitt River Power Co. from a lower court judgment which prevents the company from taking legal steps to prevent inundation of part of its property by Kennett Reservoir, a part of the government's Central Valley reclamation development. The high court's action is tantamount to upholding the action of the lower court.

Pitt River Co. began proceedings after work started on the $12,000,000 project on the Sacramento River, charging that the key reservoir, when finished, will overflow parts of the company's holdings on the Pitt River, a tributary of

the Sacramento, and will hinder proposed hydro-electric development of its property. The lower court ruled that legal action to determine property loss must await completion of the reservoir.

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Workers Oppose Rule by Bureaus

Unanimous agreement on a program of co-operation between labor and management, free from bureaucratic control, was voiced at a recent two-day session in Portland, Ore., of local representatives of local 73, International Brotherhood of Electrical Workers, including delegates from eastern Washington, eastern Oregon and northern Idaho. Carl Nelson, Spokane, was chairman of the meeting.

"The meetings were held to discuss the mutual problems of labor and management, and the necessity of a better understanding, and a unanimous agreement was reached on the progress already made," said Mr. Nelson. "It is our policy to get together with management and work out our problems together and be friends. We are unalterably opposed to bureaucratic control or interference by outside agencies. . . ."

During the session the local representatives conferred with officials of the Washington Water Power Co. Kinsey M. Robinson, president of the utility, told the representatives: "In these meetings I noticed a willingness and a desire on the part of both speakers for management and labor to give full recognition to the problems of each other and they definitely committed themselves to a program of support of private enterprise and private initiative in the coming post-war period."

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Permit Price Adjustment in Rubber-Covered Wire

Producers of rubber-covered wire and cable have been allowed by the Office of Price Administration to quote prices above constituted ceilings to reflect cost increases resulting from the April 1 boost in crude rubber prices.

Producers, however, are not allowed to collect prices higher than the ceilings in effect at the time of delivery, even though the allowable ceiling price may be below the quoted figure.

Meanwhile, OPA is studying the effect upon costs of rubber-covered wire and cable of the price increase it authorized April 1 for crude rubber used in government-used commodities.

NEWS BRIEFS

CURRENT RESEARCHES in glass, optics and light by the American Optical Co., Southbridge, Mass., have resulted in the laboratory production of a fluorescent material which gives a warm yellow color under ultra-violet exposure. Dr. W. A. Weyl, research scientist of the company, and professor of glass technology at Pennsylvania State College, whose face is illuminated by the

new fluorescent disk on the table, utilizing invisible rays from a lamp at the right, states that the new material also retains, unlike previous fluorescents, the power to emit light even if impurities like iron or nickel are present. The substance glows without the addition of an activating agent like manganese. These new properties point to simpler and more economical manufacture, with later wide use of the material in the modern illumination of homes, stores, factories and theaters.

LARGEST SINGLE EXPENDITURE of Consolidated Edison Co. of New York system in 1942 was $75,225,000 for wages, salaries and pensions, according to its annual report. The average weekly wage rose from $38.85 in 1941 to $41.55 last year, the report said.

EIGHTEEN LATIN-AMERICAN ENGINEERS who are studying this country's rural electrification program have just completed a 3,900-mile tour of industrial centers and educational institutions in eight states of the east and mid-west, the Department of Agriculture has announced. The tour was arranged by the Rural Electrification Administration, which guides the year of training provided for these young men in the United States. The program is made possible through co-operation of REA with the State Department, the Office of the Co-ordinator of Inter-American Affairs and the Office of Foreign Agricultural Relations of the Department of Agriculture. During the tour the engineers visited M. I. T., the General Electrical Institute, Harvard and Princeton Universities as well as numerous industrial plants. This is the second year a group of Latin-American engineers has studied with REA. Next year the plan will be continued.

IN A MOVE TO COMBAT ABSENTEEISM by simplifying its worker's lives, Douglas Aircraft has taken over the job of accepting payment from employees for electric, gas and water bills.

ELECTRONICS WILL BE FEATURED in a series of six lectures which started this week under the auspices of the New York Institute of Finance. A lecture will be held every Monday at 3:45 o'clock in the Governors' Room of the New York Stock Exchange. The lecturers include John Mills and Dr. K. K. Darrow of Bell Telephone Laboratories; A. C. Monteith, Westinghouse; Dr. W. R. G. Baker, General Electric; Dr. Willard F. Libby, University of California, and Dr. David Grimes, Philco Corp.

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Utility Lines Transfer Power to Co-ops

Contracts to serve two additional REA co-operatives in the Inland Empire with Columbia River power have been signed, according to an announcement by the Upper Columbia District office of the Bonneville Power Administration.

Northern Idaho Rural Electrification Rehabilitation Association, Inc., serving customers in Bonner and Boundary counties in northern Idaho, and the Pend Oreille Electric Co-operative, serving in Pend Oreille and Spokane counties in Washington, are to receive power under contracts effective on May 1.

Although the co-operatives are located some distance from the Bonneville transmission lines, Columbia River power will reach them by means of transfer agreements with two local power companies through interconnection points already established. More than 100,000 kw.-hr. per month will be routed over the Washington Water Power Co.'s lines to the Mountain States Power Co. and from there into the systems of the co-operatives.

Contracts will remain in force for 20 years subject to the transfer agreements.

Construction Budgets for '43 at $539,000,000

Federal Power Commission report says figure is lower by $216,000,000 than actual construction expenditures during 1942, which suffered from war restrictions — Pacific Coast leads

Electric utility construction budgets for 1943 total $539,000,000, according to a recent report issued by the Federal Power Commission. Of the total, $341,259,437 is budgeted for generating capacity, $75,979,535 for transmission line construction and $9,689,085 for general plant construction.

Generating Off One-third

The 1943 budget, the commission said, is lower by some $216,000,000 than actual construction expenditures during 1942, which, the report says, amounted to $755,000,000. More than a third of the anticipated decrease from the '42 figures is in the generating capacity classification, which is expected to decline about $81,000,000. Transmission line construction is down some $65,000,000, distribution $62,000,000 and general plant $8,000,000.

Of the $539,000,000 total, the report declares, $281,614,551 has been scheduled by privately managed utilities and $257,658,381 by publicly owned utilities. These figures may be compared with 1942 actual expenditures by private utilities amounting to $455,974,727 and publicly owned utilities amounting to $299,347,270. Inasmuch as some of the publicly owned utilities report for fiscal rather than calendar years, budgets for 1943 include about $196,000,000 on the fiscal year basis and 1942 actual expenditures include about $216,000,000 for the 1942 fiscal year.

"It may be noted," the report said, "that while 1941 budgets and expenditures agreed closely, 1942 expenditures, under the restriction of war measures resulting from critical shortages of materials and labor, fell substantially below the budgets for that year. Actual expeditures were $755,000,000 for 1942 against budgets of $1,069,000,000 (ELECTRICAL WORLD, May 23, 1942. page 9). The difference of $314,000,000 was divided among several classifications as follows: Generating capacity, $114,000,000; transmission, $70,000,000; distribution, $112,000,000; general plant, $18,000,000.

Geographic Breakdown

The 1943 budgets with the 1942 actual expenditures are compared by geographic divisions in the following table for the report:

Region	1943 Budget	1942 Actual
New England	$19,051,519	$38,141,518
Middle Atlantic	50,982,947	111,341,582
East North Central	91,052,896	131,346,815
West North Central	26,933,701	35,612,128
South Atlantic	71,227,307	98,158,911
East South Central	104,817,069	139,881,017
West South Central	30,427,211	38,610,326
Mountain	20,311,659	13,885,481
Pacific	124,468,623	148,343,219

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P.G.E. Answers In Contract Suit

In its answer to an action brought by the Portland General Electric trustees against Jaul J. Raver, Bonneville Administrator, and others, in the Federal District Court, the position is taken that the company now has in force a long-term contract for Bonneville power. The company pointed out that it had accepted contract offers of the Bonneville Administration on February 3, 1943, and that as a consequence the contract was now in force.

The trustees in their suit had asked for a court order ruling that P.G.E. was entitled to a contract to purchase power. The answer therefore takes issue with the trustees' complaint in so far as it might imply that a contract for power is not now in force.

The Bonneville Administration has taken the position that there is no contract because the power company had eliminated certain clauses in the original, before signing, having to do with options to purchase the Clark County, Wash., and Woodburn, Ore., properties.

The P.G.E. Company filed a suit in the federal court March 29, asking the court for an order making the contract binding.

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Utility License Tax Passes First Reading

A license or occupation tax, assessing 2 percent fee on the business of selling or furnishing electric light and power, has been set up in an ordinance passed at first reading by city council of Bremerton, Wash. The ordinance requires that after July 1, 1943, no person shall engage in or carry on a business of furnishing electricity or power without first having obtained a license to operate from the city. Puget Sound Power & Light Co. is the only company in the city selling electrical energy.

The initial tax payment under the new ordinance becomes due on July 1, and shall be paid not later than July 15, and shall be equal to 2 percent of the gross income from the business of the power company in the city during the fiscal year from July 1, 1943, to June 30, 1944.

WINS AWARD—Claude A. Cox, boiler operator, receives check for best suggestion under Connecticut Light & Power invitation plan from E. B. Ripley, superintendent of the Devon steam plant. Mr. Cox recommended an improved arrangement of vibrator in relation to the pulverized coal feeder installation. In two months more than 100 suggestions were received by the company committee from various districts and departments

System Operators Discuss Problems at P.E.A. Meeting

Utility engineers assemble in Lancaster to attend systems operation committee meeting — Post-blackout pick-up a major problem

Capacity margins, coal reserves and post-blackout pick-up were major problems discussed at a two-day meeting of the systems operation committee of the Pennsylvania Electric Association at Lancaster, May 6 and 7. It was attended by 35 system operators from the Norfolk-Buffalo-Boston area.

Only moderate increases were reported as estimates for the 1944 peaks and, with the little added capacity still to come in, there was no over-all indication of precariously small margins. Much was reported to depend on the availability of hydro and the continuance of limitations on oil fuel for unconvertible plants. Upper New York loads have flattened so much as more hydro is being used for kilowatt-hours, that less capacity is available for peaking and the 25-cycle margin is practically zero in that area. Loads in the Washington-Baltimore area in March and April were below the anticipated levels. Several companies reported new day peaks slightly exceeding previous evening peaks.

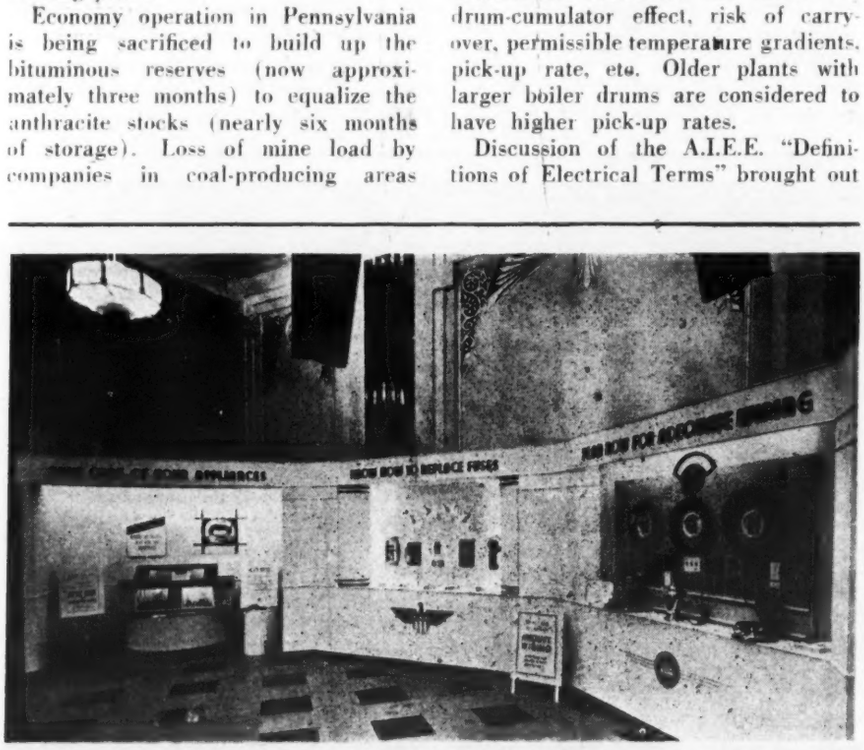
Economy operation in Pennsylvania is being sacrificed to build up the bituminous reserves (now approximately three months) to equalize the anthracite stocks (nearly six months of storage). Loss of mine load by companies in coal-producing areas would substantially extend the potentiality of current storages. One New England utility is fast approaching the $8 top reached in the first World War and is already 50 percent above the 1930-40 average cost.

Urge Data for Operators

While not yet perfectly co-ordinated, the new blackout warnings are deemed an improvement. Fear is most associated with the prospect of wide-area blackouts, in which the shock of load-drop and pick-up cannot readily be shared with unaffected areas. No serious difficulties have been experienced with dips of 50 to 60 percent, but some are considered likely if all war industries participate. Necessity for providing system operators with data on steam equipment limitations and pick-up rates was emphasized. One company prepares and posts a blackout schedule every night to fit the expected loading of the ensuing day. Another has started a crew testing all steam stations to determine the factors of drum-cumulator effect, risk of carry-over, permissible temperature gradients, pick-up rate, etc. Older plants with larger boiler drums are considered to have higher pick-up rates.

Discussion of the A.I.E.E. "Definitions of Electrical Terms" brought out the omission of the following terms of interest to interconnection operators: interchange, economy energy, load-forecasting error, incremental cost, regulating reserve.

Intensive discussion of aptitude tests for selection and advancement of operators and load dispatchers led to an understanding that several companies would participate in the development and tryout of composite tests.



LOAD SERVICING AT DALLAS—This is how Dallas Power & Light Co. helps educate its customers on adequate wiring, electrical appliance conservation and fuse replacement. Demonstrations are attended at all times by a skilled staff of home service advisers

Sets Hearing Date on C. & S. Plan

Securities and Exchange Commission has ordered a hearing for June 7 on the plan filed recently by Commonwealth & Southern Corp. under Section 11 (E) of the Holding Company Act which proposes changing the stock capitalization of the corporation to a single class of common stock, and the accomplishment of other incidental and related matters.

The commission ordered that this hearing be consolidated with all other pending proceedings involving Commonwealth & Southern under Sections 11 (B) and 11 (B) (2) of the act.

The commission order stated that particular attention will be devoted at the hearing to the question of whether the proposed action is in conformity with SEC order of April 9, 1942, which directed C. & S. to reduce its equity capitalization to a single class of stock and "what provision should be made and procedure adopted, with respect to the eligibility and nomination of directors, the use of proxy machinery, and other matters to insure that the redistribution of voting power shall be effective."

Floating Islands Over the Dam

The last of the famous floating islands in the Racquette River in the Adirondack foothills has gone over the Higley Falls dam of the Central New York Power Co. in the spring flood.

The islands were originally sections of peat bogs which floated off when the river was dammed in 1913. They moved from time to time and were an attraction for thousands of tourists. Although they were chained to the river bottom, they would occasionally break loose and drift, menaces to beaches, docks and other river works. Sixteen of them, totaling six acres in area and covered with grass, trees and shrubs, sailed majestically over the flood-crested dam.

Work on Keswick Dam to Be Resumed

WPB authorizes continuation — Friant reinstated

War Production Board this week authorized resumption of concrete work on Keswick Dam and completion of two water-control units of the Central Valley multi-purpose project in California.

Continuation of work on Keswick will facilitate ultimate completion of the Keswick power plant if installation of generators is decided upon later. It is known that the Interior Department again is urging WPB to authorize installation of generators at both Keswick and Shasta dams. Shasta at present is scheduled for two units in 1944, but a third is suspended and all units at Keswick are suspended.

In addition to authorizing resumption of work at Keswick, WPB reinstated the Friant Dam and Madera canal projects, both of which are to be completed as water control measures to improve irrigation facilities for next year as a means of increasing food supplies. Friant and the Canal will require only small amounts of critical materials and concrete work on Keswick is to continue with materials on hand or in distress stocks held for other stopped jobs.

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States' Rights in Danger—Brackman

Interference by federal agencies in state regulatory proceedings is a challenge to state rights, declared Commissioner David M. Brackman of the Massachusetts Department of Public Utilities in an address last week before the Bigelow Masters of Law of Boston University. The commissioner pointed out that rate payers would in the long run be penalized if rates should be fixed by a government agency at a lower level than the state commission having jurisdiction considers proper. Any attempt by a federal agency to dictate the rate at which electrical energy shall be supplied to a war plant when such rates are already within the purview of the state board is a threat to state regulation.

The major part of the commissioner's address covered the functions of the Bay State department and its workings, in the course of which the above warning was sounded against encroachment by federal bodies on state regulation of carriers as well as electric and other utilities.

TWO "E" FLAGS FOR SPRAGUE—Gov. Leverett Saltonstall of Massachusetts and R. C. Sprague, president Sprague Specialties Co., North Adams, Mass., manufacturer of condensers, resistors and other electronic equipment, get an impromptu salute from Sprague workers on the occasion of the presentation of two Army-Navy "E" pennants to the company's Beaver and Brown Street plants. Half the town turned out for the ceremonies —and for a good reason—half the industrial population are employed by Sprague

FPC Reports On Operating Revenues

The Federal Power Commission has inaugurated a new monthly report covering the revenues and income of privately owned class A and class B electric utilities in the United States. The report is to become part of the FPC loose-leaf "Electric Power Statistics" binder and will be sent automatically to subscribers of this service.

Issued to date is a report containing figures for the full year of 1942, and the first monthly compilation covering January, 1943. The February report was issued this week. Each report is divided into three sections, listing operating revenues by source; operating revenue deductions by broad general classes of expense, and income, and a table and chart showing the rise and fall in the various sources of revenue by geographic areas.

The 1942 Report

The 1942 report lists total utility revenues at a new high figure of $2,762,857,000. Operating expenses are reported at $1,185,024,000 (up 5.3 percent), depreciation at $288,426,000 (up 5.6 percent), taxes at $616,292,000 (up 20.4 percent). Net income is listed at $487,841,000 (down 7.4 percent). Revenues from industrial power sales were reported up 11.8 percent in 1942, while residential sales revenue increased 4.5 percent and commercial sales revenues dropped 1.3 percent.

The January report lists utility operating revenues at $248,415,000, as compared to $240,916,000 in January, 1942, an increase of 3.1 percent.

Revenues from sales to ultimate consumers were up 3.3 percent to $225,366,000, and electric operating revenue deductions (including operating expenses, depreciation and taxes) were $187,452,000, or 5.5 percent over those of January, 1942. Net electric operating revenues decreased 3.5 percent to $60,963,000, and gross income, including other utility operating income, decreased 3.0 percent to $73,779,000. Income deductions decreased 1.2 percent to $24,855,000 and were earned approximately three times, the report said. Net income in January, 1943, was down from the $50,875,000 in January, 1942, to $48,924,000, a decrease of 3.8 percent.

•

Lincoln Protests Omaha Commission Amendment

The Lincoln, Neb., city council has announced its vigorous objection to a proposed amendment to a bill creating an Omaha Power Commission for the purpose of buying the Nebraska Power Co. The amendment, if adopted, would restrict operations of the commission, when the purchase is completed, to the city of Omaha alone. Lincoln would thereby be restrained from extending its own transmission lines to its water sources in the Platte River valley.

See OPA Aid to Co-ops on Rates

Indications that the Office of Price Administration will come to the aid of rural electrification co-operatives in Arkansas, seeking to get low "developmental rates" for developed communities they have purchased, was seen when the Arkansas Department of Public Utilities set for hearings on June 1 and 2, respectively, applications of Arkansas Power & Light and Oklahoma Gas & Electric seeking to prevent such action.

When the hearing on the O.G. & E. application was scheduled late in April, lawyers for the OPA appeared before the department and charged the utilities with seeking to violate technically the Price Control Act.

The O.G. & E. sought to alter its contract with the Arkansas Valley Electric Co-operative to prevent the co-op from reselling to developed communities power it purchases under the low wholesale rate offered for rural areas.

Chairman A. B. Hill of the Arkansas department said the private companies contend they sell power to the co-operatives so low that the co-ops could undersell them in the communities affected. He cited the town of Clinton (being sold wholesale by the Arkansas Power & Light Co. before the co-op bought its system). The power company was selling the private company at Clinton power at about 2 mills and selling wholesale to the co-op in that vicinity for about 8 mills.

The OPA lawyers contend no notice of an increase in rates has been filed by the power companies with the OPA. The power companies contend the plan to sell wholesale to co-ops for re-sale in communities is not a rate increase. They point out that the low wholesale rate to co-ops was made purely to permit resale to rural areas not developed from an electricity standpoint.

•

Wisconsin Utility Group Elects New Officers

In addition to electing John G. Felton, Northern States Power Co., La Crosse, Wis., president (ELECTRICAL WORLD, May 8, page 16), the Wisconsin Utilities Association has named the following officers: S. B. Sherman, vice-president and general manager of the Wisconsin Gas & Electric Co., Racine, vice-president, and D. W. Faber, secretary and assistant treasurer of the Wisconsin Public Service Corp., Milwaukee, treasurer (re-elected). Officers will be formally installed at a dinner meeting in Milwaukee on May 24, when the association has scheduled a one-day joint war conference for all four sections at the Pfister Hotel.

•

E.E.I. Post-War Planning Committee Appointed

In addition to Hugh C. Thuerk, president of the Bradford Electric Co., who was appointed chairman of a new post-war planning committee of Edison Electric Institute (ELECTRICAL WORLD, May 8, page 17), the following members have been named to serve on the committee: Ralph E. Moody, vice-president Union Electric Co. of Missouri; W. C. Mullendore, vice-president Southern California Edison Co.; J. W. Parker, vice-president Detroit Edison Co., and George E. Whitwell, vice-president Philadelphia Electric Co. Other members will be added as the work proceeds, it was announced.

•

Texas Senate Passes River Authority Bill

Without controversy and with hardly a word of debate, the Texas Senate passed and sent to the Governor the compromise measure for a stricter state supervision of the publicly owned river authorities. The bill as passed by the Senate was identical with the House bill, details of which were published in ELECTRICAL WORLD, May 8, page 4.

It was this bill, by Representative Marshall O. Bell of San Antonio, that precipitated one of the session's hottest fights in the House. In the Senate the only speaker was Senator Karl Lovelady of Meridian, its Senate sponsor, who explained the measure and answered a few questions. The vote on final passage was 18 to 7.

As the result of the appointment by Gov. Coke R. Stevenson of three members to the Lower Colorado River Authority Board, W. B. Arnold of San Antonio, L.C.R.A. board chairman, fades out of the set-up. The appointments by the Governor are Paris Smith, former legislator, banker and merchant of Bay City, to succeed Carl White of Port Arthur; C. Kuykendall, banker of San Saba, to succeed Mr. Arnold; Orville Buttery, ranchman of Llano, to succeed John H. Paine of Austin.

After a legislative investigation was made by a committee of which Rep. J. E. Winfree of Houston was chairman, it was charged that the river authority board members questioned in the course of the investigation were not sufficiently informed on operating detail.

The new selections were made after personal study by the Governor, who made several trips over the L.C.R.A. area.

•

Second Shasta Unit Goes on Line at Coulee

For the second time in three months a block of 75,000 kw. of power has been added to the capacity of Grand Coulee Dam, Secretary of the Interior Harold L. Ickes has announced. The unit is the second of two generators originally constructed for Shasta Dam in California and transferred to Grand Coulee. The first went on the line in February.

MEETINGS

Wisconsin Utilities Association — One-day war conference, Milwaukee, Wisc., May 24. A. F. Herwig, secretary, 135 W. Wells St., Milwaukee, Wisc.

Public Utilities Advertising Association—Annual meeting, Edgewater Beach Hotel, Chicago, Ill., June 24-25. Waldo M. Wright, secretary, Amarillo Gas Co., Amarillo, Texas.

Previously Listed

Pennsylvania Electric Association — Electrical equipment committee, Penn Alto Hotel, Altoona, Pa., May 20-21; A. N. Shealy, chairman, Pennsylvania Water & Power Co., Baltimore, Md. Meter committee, Roosevelt Hotel, Pittsburgh, Pa., May 21; S. J. De Luca, chairman, Chester County Light & Power Co., Wilmington, Del.

National Electrical Wholesalers Association—War conference, Hotel Statler, Buffalo, N. Y., May 24-26. Alfred Byers, secretary, 165 Broadway, New York, N. Y.

Edison Electric Institute—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., June 2-3. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York, N. Y.

Illuminating Engineering Society — Great Lakes regional conference, Rackham Memorial Bldg., Detroit, Mich., June 5; G. R. Baumgartner, regional vice-president, General Electric Co., Nela Park, Cleveland, Ohio. Northeastern regional conference, Shelton Hotel, New York, N. Y., June 11; C. C. Keller, regional vice-president, Holophane Co., 342 Madison Ave., New York, N. Y.

National District Heating Association — Annual meeting, Hotel Schenley, Pittsburgh, Pa., June 9-10. John F. Collins, Jr., secretary-treasurer, 827 N. Euclid Ave., Pittsburgh, Pa.

American Society of Mechanical Engineers—Semi-annual meeting, Hotel Biltmore, Los Angeles, Calif., June 14-16. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York, N. Y.

Canadian Electrical Association—Annual meeting Seigniory Club, Quebec, June 17-18. B. C. Fairchilds, secretary, 804 Tramways Bldg., Montreal, Que.

Society for Promotion of Engineering Education —Annual meeting, Illinois Institute of Technology, Chicago, Ill., and Northwestern University, Evanston, Ill., June 18-20. F. L. Bishop, secretary, University of Pittsburgh, Pittsburgh, Pa.

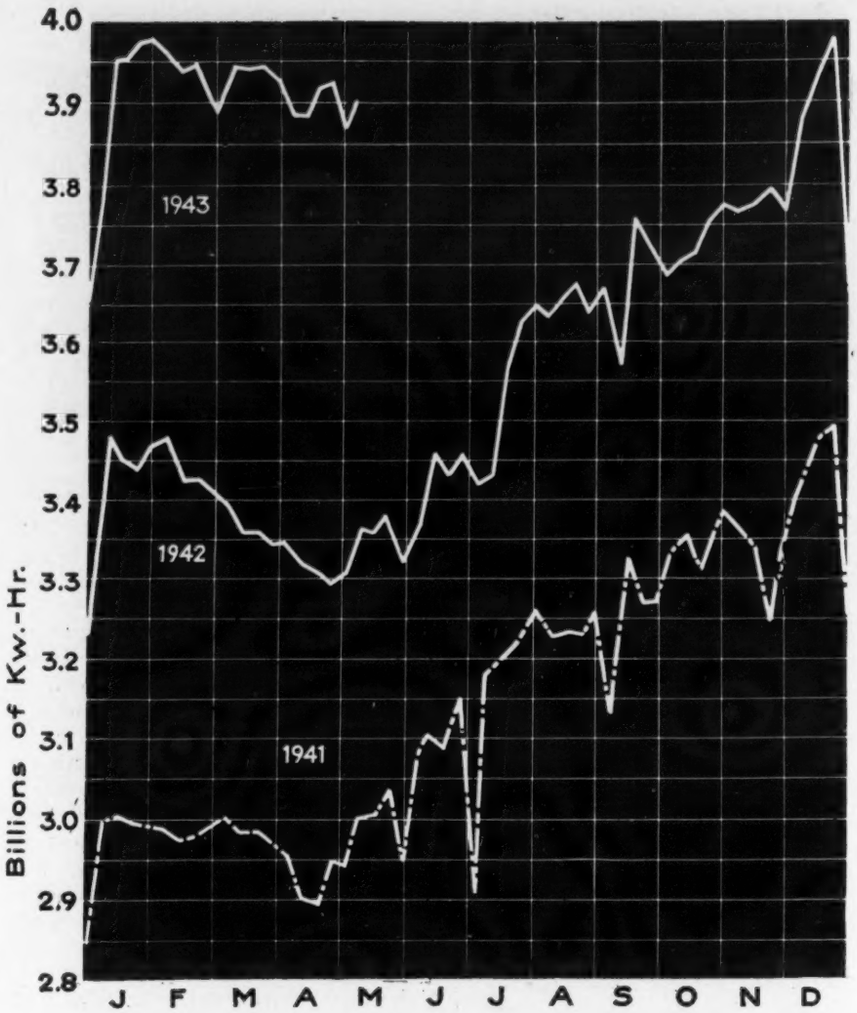
American Insitute of Electrical Engineers — National technical meeting, Hotel Cleveland, Cleveland, Ohio, June 21-25. H. H. Henline, national secretary, 33 W. 39th St., New York, N. Y.

American Society for Testing Materials—Annual meeting, Pittsburgh, Pa., June 28-July 1. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

Output for Week Moves Upward

The amount of electrical energy distributed by the electric light and power industry for the week ended May 8 was 3,903,723,000 kw.-hr., according to the Edison Electric Institute. This figure compares with 3,866,721,000 kw.-hr. for the preceding week and with 3,925,175,000 kw.-hr. for the week ended April 24. Figures for the latest week represent an increase of 16.0 percent over the corresponding week in 1942—a decrease of 1 percent compared to previous week's gains over 1942 figures.

Among the major geographic regions of the country, the Pacific Coast continued to lead in percentage gain over 1942 with 32.9 percent. The Rocky Mountain region during the week ended May 8 took second place from the Southern States, with a percentage gain of 17.0 percent, while the Southern group showed only a gain of 14.4 percent over 1942. Last week the Southern States showed a gain of 19.5 percent; Rocky Mountain region, 15.0 percent. The Central Industrial and the West Central geographic regions showed slight losses as compared with the percent changes reported for the preceding week over 1942.



Weekly Output, Millions Kw.-Hr.

1943		1942		1941	
May 8	3,904	May 9	3,365	May 10	3,001
May 1	3,867	May 2	3,304	May 3	2,945
Apr. 24	3,925	Apr. 25	3,273	Apr. 26	2,950
Apr. 17	3,917	Apr. 18	3,708	Apr. 19	2,897
Apr. 10	3,882	Apr. 11	3,321	Apr. 12	2,905
Apr. 3	3,890	Apr. 4	3,348	Apr. 5	2,959
Mar. 27	3,928	Mar. 28	3,345	Mar. 29	2,975
Mar. 20	3,947	Mar. 21	3,357	Mar. 22	2,983
Mar. 13	3,945	Mar. 14	3,357	Mar. 15	2,983
Mar. 6	3,947	Mar. 7	3,392	Mar. 8	3,005

Percent Change from Previous Year

	Week Ending		
	May 8	May 1	Apr. 24
New England	+ 8.1	+ 8.1	+ 9.5
Mid-Atlantic	+13.3	+13.0	+16.7
Central Industrial	+14.0	+14.3	+17.3
West Central	+12.3	+12.9	+14.4
Southern States	+14.4	+19.5	+24.9
Rocky Mountain	+17.0	+15.0	+13.9
Pacific Coast	+32.9	+32.4	+32.6
Total United States	+16.0	+17.0	+19.9

Vote on Imperial Valley Facilities Due Soon

Another step has been taken in connection with the proposed sale by California Electric Power Co. of its property in the Imperial Valley to the Imperial Irrigation District with the recent passage by the California Legislature of a bill defining the boundaries of the district for the purpose of holding an election to approve the sale.

Although statutory requirements call for a ten-day notice of such election, it is believed that a long period will be given and the election is expected to be held late this month.

•

March Energy Production

Electric energy produced for public use in March, 1943, totaled 17,548,636,000 kw.-hr., an increase of 18.7 percent over production in March, 1942, according to the Federal Power Commission. Average daily production of electric energy for public use in March was 603,045,000 kw.-hr., a decrease of 0.7 percent from daily average production during the previous month. Production of water power in March amounted to 6,599,339,000 kw.-hr., or 37.6 percent of the total output for public use.

•

Maryland Utility Group Holds Spring Meeting

The spring conference of the Maryland Utilities Association, which was held on April 30 at the Belvedere Hotel, Baltimore, Md., was a combined meeting of the electric, transportation and gas groups. The meeting was opened by President Lewis Payne, who introduced C. B. Melton, chairman of the combined meeting.

Speakers on the program were: T. P. Walker, president, Council of Electric Operating Companies, Washington, D. C.; William E. Mitchell, vice-president and general manager, Georgia Power Co.; Capt. H. Cotton Minchin, British Embassy, Washington; E. J. Boothby, vice-president and general manager, Washington Gas Light Co., and Brig.-Gen. William C. Rose, War Manpower Board.

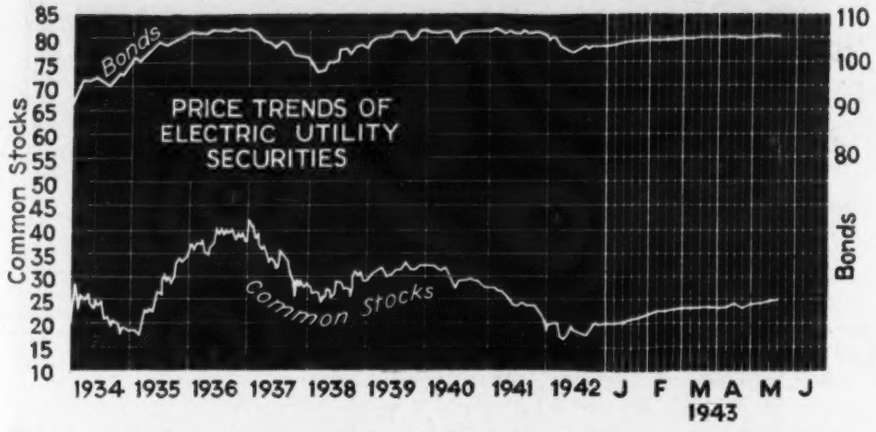
Mr. Payne was re-elected president for the 1943-44 term, as were the other officers.

•

Pepco Hearings to be Resumed on May 25

The Securities and Exchange Commission has announced a reconvening of hearings on a plan for the reorganization of Portland Electric Power Co. The hearings will be held as before in Portland, Ore., and will begin on May 25, the commission said.

Utility Stocks Shoot Upward; Bonds Gain



With an acceleration of their recent upward trend, electric utility stocks led the market this week. "Electrical World" index jumped from 24.8 to 25.3; last year, 17.5. Bonds gained 0.1 point, reaching 105.5; last year, 102.4

North American Pays in P.G.&E. Stock

North American Co. took steps this week to divest itself ultimately of its one-third common stock interest in the Pacific Gas & Electric Co. Directors of North American declared a common stock dividend in the form of one share of common stock of Pacific Gas for each 100 shares of North American common stock held.

The dividend will be paid on July 1 to stockholders of record on June 2, subject to the approval of the SEC. In place of fractional shares of Pacific Gas common, it was announced, cash will be paid at the rate of 29 cents a share, based on the current market price of $28.87½ for P. G. & E. common.

It is estimated that the July 1 dividend will result in a distribution of approximately 75,000 shares of P. G. & E. common stock to North American common-stock holders.

•

General Gas Recap Plan is Proposed

A new plan for recapitalization of the General Gas & Electric Corp., providing for corporate simplification, divestment of assets and more equitable distribution of voting power, was announced recently by trustees in reorganization of Associated Gas & Electric Corp., the parent concern. The plan was filed with Judge Vincent L. Leibell in New York federal district court, who authorized its submission to the Securities and Exchange Commission. Judge Leibell's approval of the plan also brought his comment that he expected reorganization of Ageco and Agecorp to be completed this year.

The plan, which supersedes one filed March 4, 1941, proposes to give certain common stocks of subsidiaries of General Gas & Electric to the public holders of cumulative preferred stocks and class A and class B common stocks in place of their present holdings. Public holders of General Gas preferred are to receive preferred stock in South Carolina Electric & Gas Co., a new concern resulting from the merger of Lexington Water Power Co. and South Carolina.

Public holders of class A and class B common of General will receive different treatment, depending on whether they acquired their holdings before or after October 31, 1932. "Original" holders will receive for each share of common held 1½ shares of Florida Power Corp. common. Later holders will get one-half share of Florida common. The latter company would be set up by merging Florida Power Corp., Florida Public Service, Sanford Gas, Sante Fe Land Co. and Georgia Power & Light—all General Gas subsidiaries.

•

U.G.I. Sells Subsidiary

The Securities and Exchange Commission has approved the proposed sale by United Gas Improvement Co. of its holdings of 71,805 shares of preferred and 39,046 shares of common stock of its subsidiary, Connecticut Railway and Lighting Co., to Charles Ulrick Bay for $1,815,000 in cash. The commission also granted U.G.I. permission to buy $5,303,000 of Connecticut Railway & Light's bonds from the public for resale to Connecticut Light & Power Co.

FINANCIAL BRIEFS

California Electric Power Co. will receive bids up to May 17 for the underwriting of $20,000,000 of bonds to refund part of the company's 5 percent first mortgage bonds, due 1956. Sale of the issue not later than July 31 is proposed.

Oklahoma's State Equalization Board has unanimously accepted tax commission recommendations to increase assessed valuations of public service corporations in Oklahoma by $23,795,228.

The SEC has ordered a hearing for May 27 on a plan of liquidation and dissolution of North American Gas & Electric Co., and Loeb & Eames, Inc., its wholly-owned subsidiary, filed recently with the commission.

City of St. Louis has intervened in the SEC's proposed hearing into the plan for reorganization of the Laclede Gas Light Co., involving the sale of the properties of the Laclede Light & Power Co. to Union Electric Co. of Missouri.

Hillsdale, Mich., municipal power plant became debt free May 1 with the retirement of the finals bonds of a $130,000 issue in 1938 for plant improvement and expansion.

The SEC has approved a proposal of National Power & Light Co. to surrender for cancellation to Easton Transit Co., a subsidiary, as a capital contribution, 41,000 shares of the 43,000 outstanding shares of Easton stock and the sale of the remaining 2,000 shares to Lehigh Valley Transit Co. for $10,000.

SEC has approved a dividend payment of $20,000 to holders of Central Ohio Light & Power Co.'s common stock.

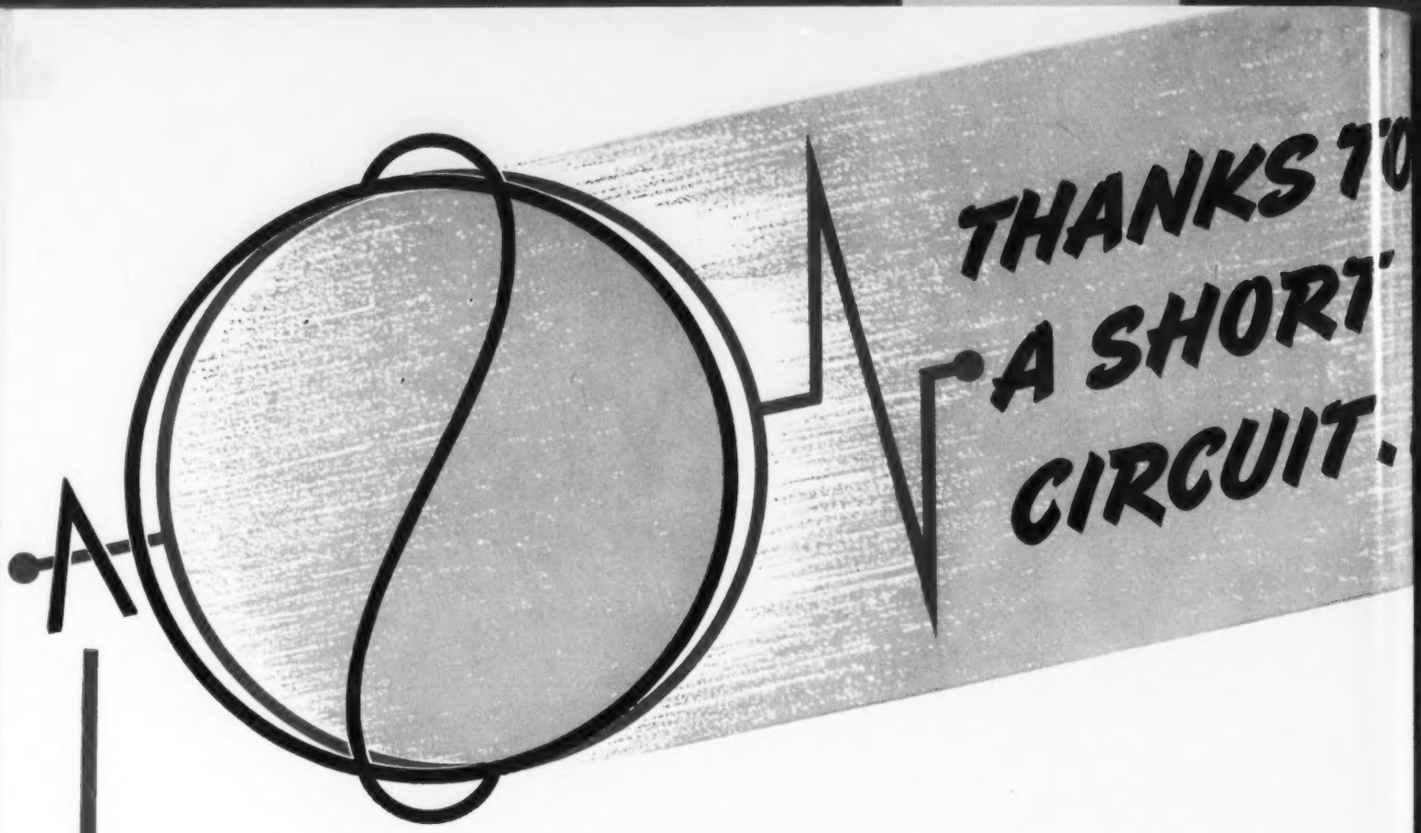
Utility Reports

	Net Income 1943	1942
*Arkansas Power & Light..	$1,173,903	$2,017,768
*Boston Edison	5,209,939	5,523,387
*Brooklyn Edison	7,602,963	10,375,839
*Central Maine Power.....	3,424,424	3,192,736
*Central Power & Light....	1,405,998	1,357,775
*Commonwealth Edison and subs.	21,901,641	25,600,582
*Dallas Power & Light....	1,490,510	1,746,970
*Louisiana Power & Light..	1,331,432	1,078,676
*Long Island Lighting.....	1,820,252	1,322,813
*Mississippi Power & Light.	745,471	534,042
*New Orleans Pub. Serv...	2,288,493	2,268,836
*Oklahoma Gas & Elec.....	2,504,855	2,316,789
*Pacific Lighting Corp.....	6,274,075	6,312,592
*Philadelphia Electric and subs.	16,864,616	17,727,842
*Superior Water, Lt. & Pwr.	233,884	72,762
*Tampa Electric	1,173,566	1,176,163

*Twelve months ended March 31.

THE SHORT CIRCUIT...

That Moves Mountains



ON our far-flung fighting fronts, and along our industrial front, a short circuit *in harness* is increasing the deadliness of our war weapons, speeding war production, conserving vital man power and materials. Its name—the G-E AMPLIDYNE.

In principle, the amplidyne is an externally driven d-c dynamo-electric machine. By unique use of a short circuit, together with load-current compensation, General Electric engineers have combined in it such high amplification and speed of response that tiny electrical signals release *kilowatts* of output capable of controlling the heaviest machinery.

With strength and amazing speed, the amplidyne executes the whispered orders of relays, selsyns, limit switches, electronic tubes, resistances—almost any source of control current. It maintains continuous control of voltage, current, speed, or position, instantly correcting any departure from the desired conditions.

The thousands of G-E amplidynes now in industrial and war service point to a future that challenges the imagination. The amplidyne will simplify your electrical systems and make them more flexible. Because its characteristics are permanently built-in, it will assure consistent performance year after year, yet it can be readily adjusted to meet changing requirements. It has a place wherever an electrical signal can express the need for a change, or prevent a change, in process.

To help you fit this versatile new tool into your plans for present and post-war improvements in product or process, G-E application engineers offer their full co-operation. Call on them freely.

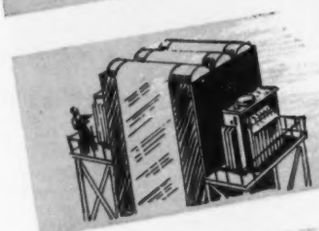
GENERAL ELECTRIC

OUTPUT STEPPED UP

150 tons per shift—on giant cold-strip mills

DEADLINESS INCREASED

—of our land, sea, and air weapons



REJECTIONS DROPPED 50%

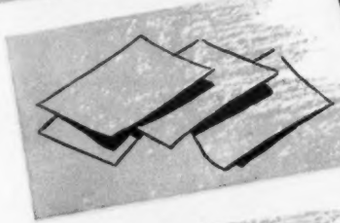
—on two tin-plate flow-brightening lines

CAPACITY ROSE

70,000 tons per month—on the world's largest shovel

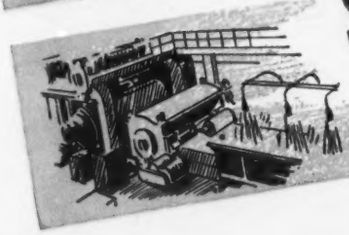
SPEEDS CLIMBED

—in the performance of high-speed planers



VARIETY WIDENED

in the number of grades of paper that could be made on a single machine



SAVINGS TOTALLED $30,000

—in the cost of a new flying-shear installation

AMPLIDYNE

WHAT THE AMPLIDYNE DOES

CONTROLS SPEED

—accurately—over a wide range. Matches machine speeds to maintain continuous process control.

SPEEDS UP ACCELERATION

and deceleration, to increase production of high-inertia machines.

LIMITS LOADS

—to protect electric systems, to eliminate shock loads and destructive stresses on mechanical equipment.

POSITIONS PRECISELY

for fast and accurate setting of machine tools, arc-furnace electrodes and other equipment.

HOLDS TENSION

—to improve product uniformity in winding, rolling, and drawing operations.

REGULATES CURRENT,

voltage, power, and speed to maintain steady conditions, to improve power factor.

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Mail the coupon today for your free copy of "The Short Circuit That Moves Mountains", 28 pages with photographs and circuit diagrams showing what the G-E AMPLIDYNE does, how this unique amplifying generator operates, and where it can help you.

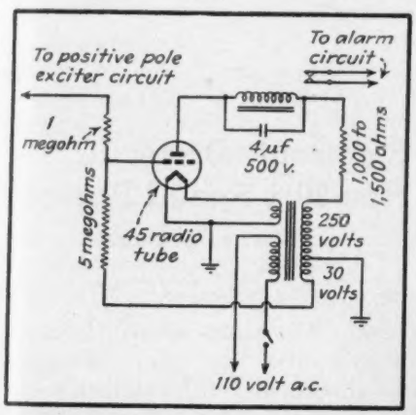
GENERAL ELECTRIC

HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

Electronics Detects Grounds on Field

By A. H. BARDEWYCK
Assistant Chief Engineer
Cía de Electricidad de Sud Argentino, S. A.
Buenos Aires, Argentina

A simple electronic ground detector has been devised by engineers of this company for detecting grounds on the field circuits of turbo-generators.



GROUND on field circuit completes grid circuit and lowers the blocking potential by the amount of the resulting drop in 6-megohm resistor

A type 45 radio tube is employed and the plate and grid of this tube are supplied with alternating voltage in such a manner that when the positive cycle of this voltage is impressed upon the plate the grid is negatively charged, thus blocking the action of the tube. As can be seen from the attached diagram, should a ground occur at any point in the field circuit of the generator the grid-blocking voltage required to maintain the tube inoperative disappears, thus permitting current flow and causing the operation of the telephone type relay in the plate circuit. This relay may be made to operate an alarm or may be made to trip the main circuit breaker of the generator as desired.

With the values shown in the attached diagram the ground detector will operate should a ground having a value of $\frac{1}{2}$ megohm or less occur in the field circuit. By adjusting the grid-blocking voltage and the dividing resistances in the grid circuit the device may be made to operate at almost any desired value of ground resistance in the field circuit.

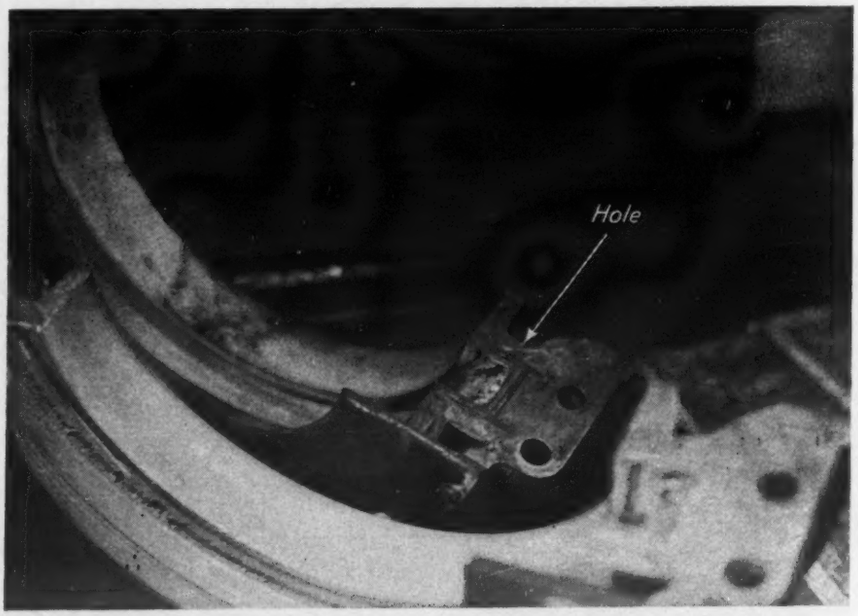
While a type 45 radio tube has been utilized in the equipments built locally due to ruggedness, low cost and fairly high plate current of this type tube, almost any vacuum tube of the type used in the output circuits of low frequency power amplifiers may be utilized.

Stainless Channels Restore Packing

By CHARLES KIEL
Superintendent of Power Plant
Queens Borough Gas & Electric Company,
Far Rockaway, N. Y.

Cutting due to impingement of wet steam at the low-pressure packing-gland casing of a 20,000-kw., 400-psi. turbine caused considerable erosion of the metal during several years of operation. At one point the packing ring was perforated by the erosion.

The affected metal was machined off the runner channel faces. A new channel was fabricated from $\frac{3}{16}$-in. stainless steel sheets cut in two sectors and a strip curved to fit the gland. It is expected that the new metal will stand up at least as well as, if not better than, bronze.



ERODED low-pressure packing of 20,000-kw. turbine rehabilitated with stainless steel channels; hole eroded clear through metal

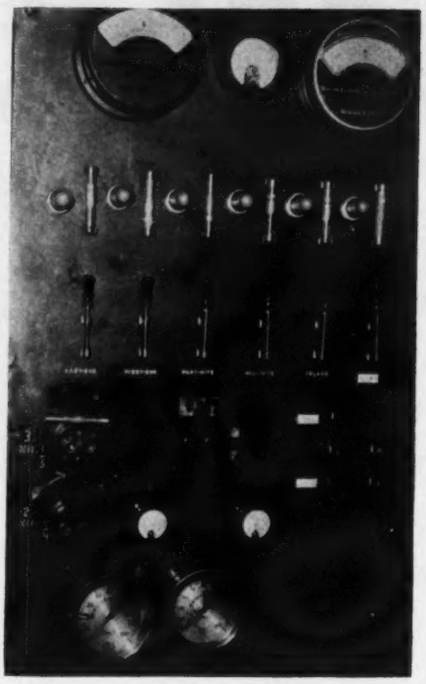
Pilot Wire Controls 110-V. Street Lights

Multiple street lights and off-peak water heaters are controlled by separate pilot wire circuits on the system of the Menasha (Wis.) Electric and Water Utilities. Essential elements of the two basically similar pilot wire systems are shown in the accompanying diagram.

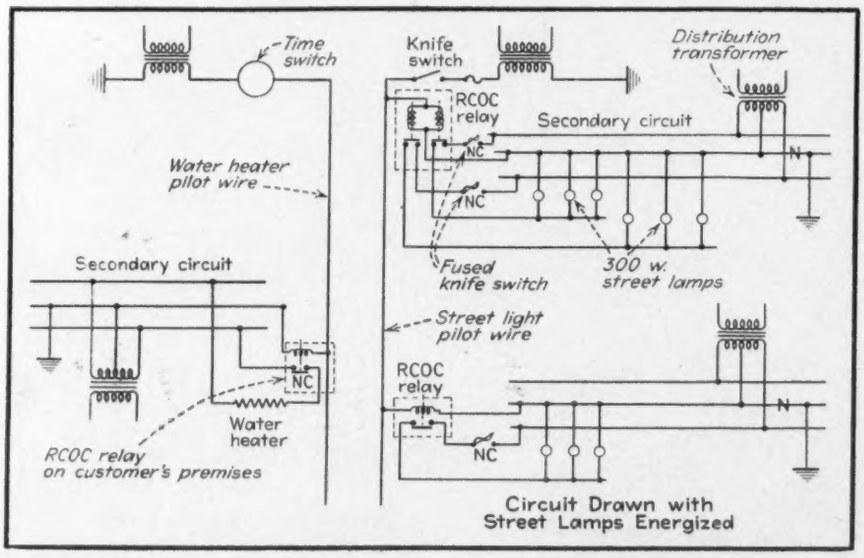
In converting from a series to a multiple system, several years ago, street lights at Menasha were arranged to operate at 110 volts, supplied from distribution transformer secondary circuits. Existing conductors of the series-lighting circuits were used for the pilot wire system throughout the city. No new conductors were necessary and in several locations wire was actually salvaged in making the conversion.

In any given section of the city one conductor of the original series circuit was converted into a pilot wire. A potential of 110 volts to ground was impressed on the pilot at the city power plant, during daylight hours, through a single-pole, single-throw knife switch in series with the pilot. At points along the pilot wire, usually corresponding with distribution transformer location, a Line Material type RCOC relay coil was connected between the pilot and the grounded neutral of the secondary circuit.

Relay contacts are in series with a 110-volt street light "supply" conductor connected to one or both sides of the distribution transformer secondary. The street lamps, usually 300 watts, are connected between this supply conductor and the grounded secondary neutral. Contacts of the relay are open during daylight hours when the pilot wire and relay coil are energized. At night, when street lamps are on, potential is removed from the pilot, allowing the relay contacts to close.



KNIFE SWITCHES on central control panel are closed during daylight hours when street lights are "off." Note several switches corresponding to several pilot wire circuits



ESSENTIAL ELEMENTS of simple pilot wire control for multiple street lights and off-peak water heaters (left). Street light pilot wire is "dead" when lights are on

Since the pilot wire is de-energized when the lamps are on, any break in the pilot wire during daylight hours will energize the street lamps, simplifying the location of trouble. In the business section of the city alternate lights are on a separate "part-night" pilot circuit and can be turned off at midnight.

Approximately 700 off-peak electric water heaters are controlled by a modification of the street light pilot wire system. A separate pilot is required for this system and, like the other, is energized at 110 volts from the power plant, but through a time switch rather than a manually operated knife switch.

Relays for the water heater pilot control are located in the customers' houses and, unlike the street light relays, have their contacts closed when the pilot wire is energized. Relay contacts when closed apply 220 volts to the water heaters, which are under individual thermostatic control. The time switch at the central plant turns all water heaters off between 10:45 and 12:15 a.m. and 4 and 9 p.m. During the rest of the day the heaters are "on."

•

Electronic Drive Has 20:1 Speed Range

By T. R. LAWSON
Application Engineer, Electronic Section, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

An adjustable-speed electronic motor drive has been developed which provides for constant preset speed at varying loads over a 20:1 speed range. Four principal equipments involved are power transformer, electronic control, control station and d.c. motor. Incoming a.c. power is converted by grid-controlled rectifier tubes and supplied to the armature and field of the d.c. motor.

This electronic motor drive, known as the "Mot-O-Trol," was designed by Westinghouse to fulfill requirements of an a.c. adjustable-speed motor. Although the basic idea is not new, this recently developed drive provides constant torque for all speeds up to base motor speed and constant horsepower above base speed.

The electronic control unit for motors 1 hp. and smaller uses single-phase, full-wave rectification. For

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Superimposed on transmission lines, it makes possible increased interconnections between systems, and new tap points in major transmission lines without loss of stability. It also permits increased safe loading of these lines and more effectively utilizes generating capacity. Power companies have found that carrier current applications make it unnecessary to build new transmission lines, generating stations, and pilot lines to handle the rocketing kilowatt demands of war plants.

Carrier current equipment saves tons of vital war materials — copper, steel, and aluminum — for every pound of these vital metals used in its construction. And it saves manpower through lower operating and maintenance requirements.

Remarkable savings of insulation, generating and other equipment are everywhere demonstrated in practice . . . made possible by such carrier current functions as pilot relaying, transfer tripping, automatic load control, telemetering, and telephony.

Our representatives will gladly discuss with you the possibilities of increasing the reliability, flexibility, and capacity of your transmission lines with G-E carrier current. . . . *Electronics Department, General Electric, Schenectady, New York.*

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GENERAL ELECTRIC

151-82-6920

motors of larger horsepower rating a two-phase, full-wave or three-phase, half-wave-rectifier may be used, depending on the economical application of tubes.

Connections for the smaller control units are shown. Power taken from a conventional a.c. line is rectified by two WL-672 tubes and supplied to the motor armature through the reversing contactor RCR-LCR. Another rectifier system includes two KU-627 thyratron tubes that supply rectifier voltage to the motor field. The field voltage is held constant throughout the range of armature voltage and then is reduced to provide greater speed range by field weakening above the base speed of the motor.

Functions of speed regulation and current limit acceleration are performed by automatic readjustment of the angle of ignition of the thyratrons in accordance with the magnitude of armature voltage and current. Speed of the motor remains essentially constant regardless of torque, even at the lowest possible speed, it is claimed. Armature current is never permitted to exceed the predetermined value. Speeds within the 20:1 speed range are selected by manual adjustment of the angle of ignition.

Speeds may be preset, within the design range. With two speed-control potentiometers and reversing contactors, different forward and reverse speeds may be preset, so that only the operation of the forward or reverse pushbutton is necessary to obtain a predetermined speed in either direction. Speed adjustment may be made at any time while the motor is running.

In a properly adjusted system the speed over a 10:1 range will not vary more than 4 percent from a presetting, with torque varying from no load to full load. Nor will it vary more than 8 percent for any speed within the speed range of 20:1. Normal variations in a.c. line voltage have only a small effect on the speed regulation.

As soon as the stop push button is depressed a dynamic breaking resistor is automatically connected across the armature. The current is interrupted by the thyratron tubes rather than by the magnetic contactor. Amount of breaking resistance is adjustable.

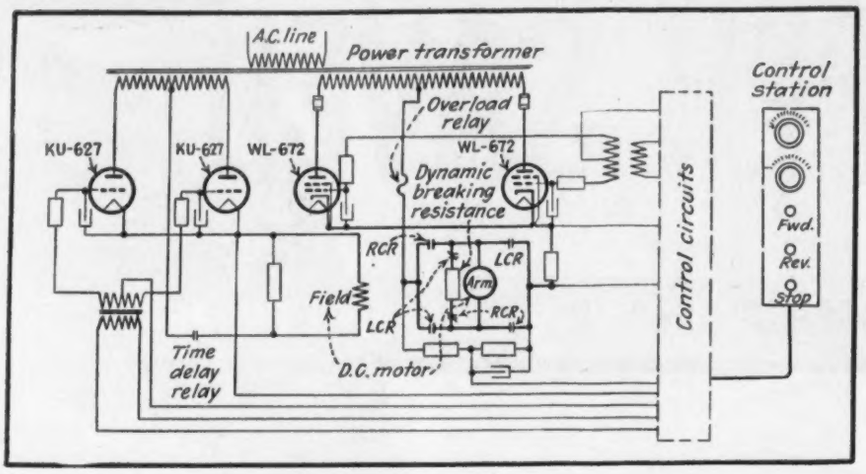

DIAGRAM of connections of power circuit for Mot-O-Trol

•

Lineman, Patrolman Training—II*

By C. T. MALLOY
Superintendent
Transmission and Communication Department,
Southern California Edison Co., Ltd., Los Angeles

To be eligible for advancement and pay increases of each of the successive steps in the training schedule for transmission line work, an apprentice must have the recommendation of his field foreman and satisfactorily pass an examination or test that will determine his ability and knowledge of the trade.

The following fourteen items are some of the important features of the work that must be assimilated before the employee may be advanced to the second step in apprentice training:

1. Be capable of properly applying first aid and Schafer method of artificial respiration.
2. Know the names and use of tools and equipment used in line work.
3. Be able to tie the following knots and hitches: square knot, bowline, clove hitch, timber hitch, grapevine hitch, and half hitch.
4. Show an aptitude and ability to climb poles and towers.
5. Be capable of gaining a pole and framing a crossarm.
6. Be able to do, under the supervision of a lineman, minor work on a pole or tower on unenergized circuits and at levels below energized circuits.
7. Know and be able to give the standard arm signals that are used in line work.
8. Be able to identify various circuits by voltage and classification on a pole or tower.
9. Know all safety rules that apply to line work.
10. Be capable of driving and handling a truck in a safe manner, and know the fundamental laws and regulations that govern the use of cars and trucks on highways.
11. Be observant and capable of describing conditions noted on the line or job.
12. Realize the importance of and practice "good housekeeping" on the job.
13. Be safety minded and work safely.
14. Be able to describe the three most common hazards of line work and what should be done to safeguard against them.

Before an employee can be advanced to the third step in apprentice training for patrolman and second class lineman in the transmission division he must be able to assimilate additional important features of transmission line work. Some of the features are:

1. Be proficient in applying both the pole-top and Schafer methods of artificial respiration.
2. Be adept in climbing poles and towers.
3. Be capable of performing routine line work on unenergized circuits and know the proper methods of attaching conductors to insulators.
4. Know all transmission orders that pertain to field work.
5. Know how to make the following splices in rope: back splice, eye splice, and long or running splice.
6. Be familiar with the supervision and emergency call routine of the division in which he works.
7. Know the proper method and procedures for making splices in 66-kv. and telephone wires.
8. Have a fair knowledge of standard construction methods.
9. Have ability to get along with other employees.
10. Know the proper use and care of rubber protective equipment.
11. Know the proper use and care of safety belts.
12. Be able to trim trees properly and describe the procedure.
13. Have a fair knowledge of electric circuits as they may affect a lineman's work.
14. Know the proper precautions that must be taken to work on de-energized circuits.

A guide for the requirements to advanced steps in the training schedule will be listed in a subsequent article.

*Second of three-article series which began in the May 1, 1943, issue of "Electrical World."

SAFETY FIRST
1. "So my youngster says to me, 'Pop, what are you doing to win the war?'
2. "I wish my kid would ask simple questions like that.
3. "Yeah, that was easy. All you had to say was we're the guys . . ."
4. ". . . who keep electrical apparatus on the job for steady war production."
5. "You fellows talk too much. Hurry up with those jobs so I can put a red coat on them."
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GENERAL ELECTRIC

HOW FIBRE DUCT CAN SAVE CONDUIT IN INDUSTRIAL WIRING

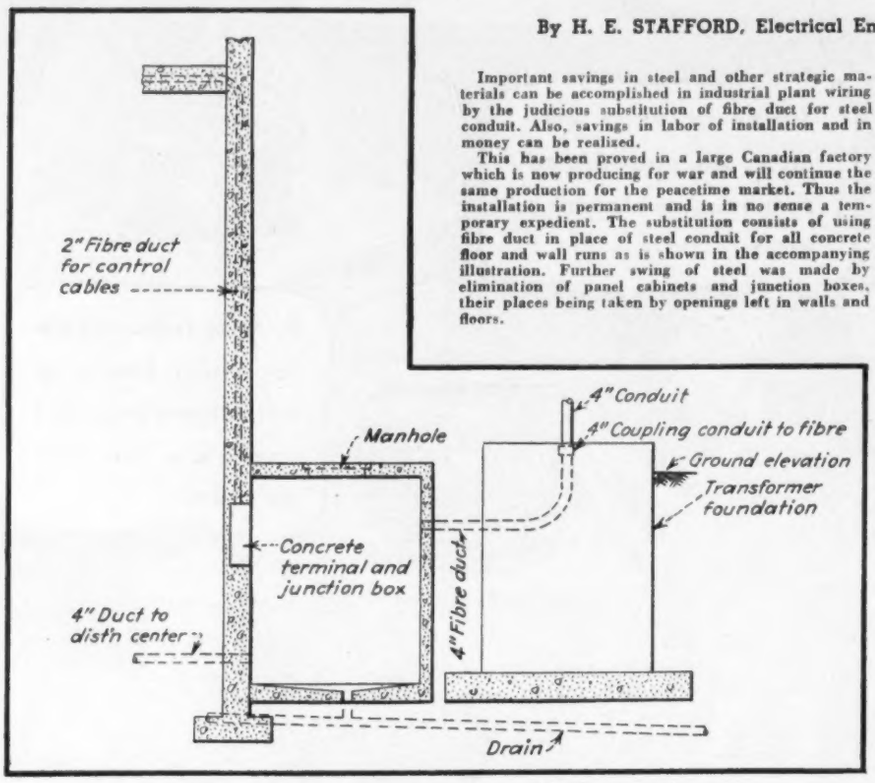
By H. E. STAFFORD, Electrical Engineer, Port Arthur, Ontario, Canada

Important savings in steel and other strategic materials can be accomplished in industrial plant wiring by the judicious substitution of fibre duct for steel conduit. Also, savings in labor of installation and in money can be realized.

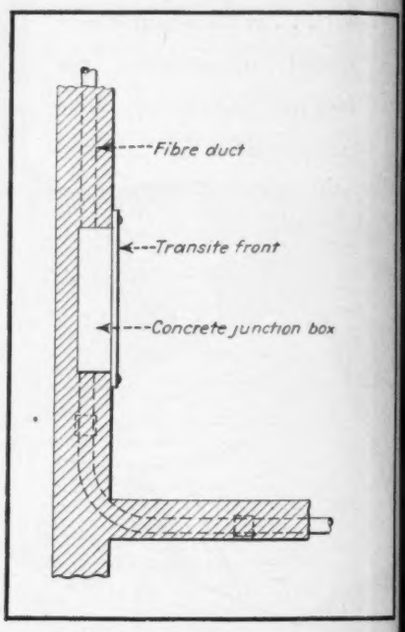
This has been proved in a large Canadian factory which is now producing for war and will continue the same production for the peacetime market. Thus the installation is permanent and is in no sense a temporary expedient. The substitution consists of using fibre duct in place of steel conduit for all concrete floor and wall runs as is shown in the accompanying illustration. Further swing of steel was made by elimination of panel cabinets and junction boxes, their places being taken by openings left in walls and floors.

These openings were covered with Transite panels, and presented as good appearance as flush-mounted steel cabinets and boxes.

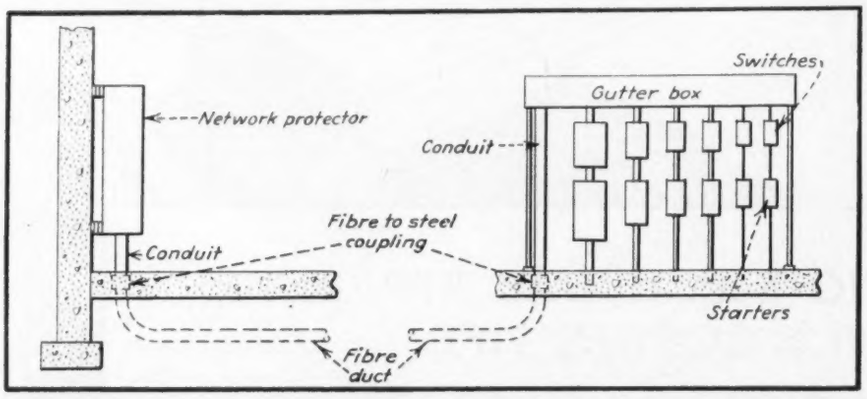
In this plant there are six 110-ft. runs of 3¼-in. fibre duct, each run taking the place of six lines of 1½ and 1¼-in. steel conduit that would have been installed if usual practice had been followed. Thus 660 ft. of fibre duct saves the use of 3,960 ft. of steel conduit with accompanying estimated economies of 5/6 of conduit cost and 2/3 of labor cost, amounting to over $500. As conduit was used only where it was impossible to employ fibre duct, as in lighting circuits and in short runs to small and medium-rated motors. The savings on the whole job were considerable and a large amount of steel was released for more urgent purposes.



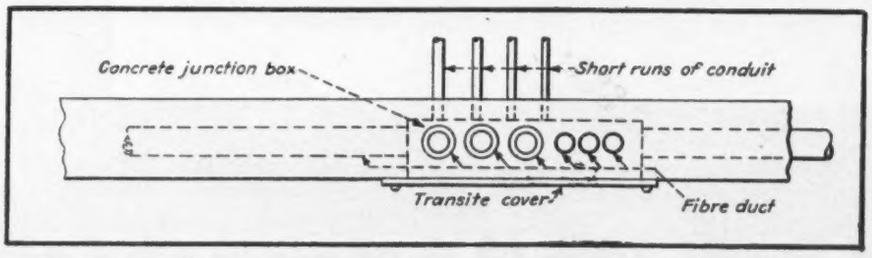
RUNS of 4-in. duct outdoor transformers to manhole and from manhole to distribution center



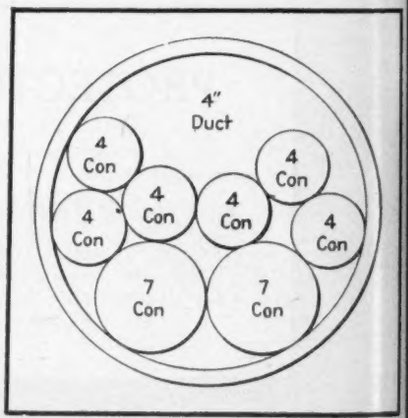
OPENING 2½ ft. high, 2 ft. wide, 8 in. deep in 12-in. wall serves as junction box



FIBRE DUCT run from distribution center or network protector to a rack of motor starters; short pieces of steel conduit are used to complete runs in open



TRANSITE-COVERED concrete junction box in ceiling with conduit runs to points of use on floor above



CROSS-SECTION of 4-in. duct containing eight control cables with room for more; braid-covered cables were used in dry locations; lead-covered in underground runs; duct bends avoided as much as possible to facilitate pulling in cable

AIR is LIFE to a sub crew...

but DEATH to unstable turbine oils!

WHEN oxidation attacks, unstable oils can't last long. That's why turbine operators are switching to the new Shell Turbo Oil. There's not another turbine oil today that can match its ability to resist oxidation.

For positive proof, check the 19,851 hrs. performance record of the Norton Co., abrasive manufacturers, shown below. It is but one of the scores of examples that prove Shell Turbo Oil not only has superior oxidation stability—it also prevents rust!

For further details on this and other outstanding performances of Shell Turbo Oil call in the Shell man. Or, write Shell Oil Company, Inc., Dept. "B", 50 W. 50th St., New York, N. Y., or 100 Bush St., San Francisco, Cal.

Certified Proof of the Superior OXIDATION STABILITY of Shell Turbo Oil

CHARACTERISTICS		
156	*Viscosity @ 100° F.*	157
Clear	*Appearance*	*Clear*
LT .05	*Neutralization No.*	*.02*
LT .2	*Saponification No.*	*.2*
90	*Steam Emulsion No.*	*90*

Performance record of Shell Turbo Oil in 2500 kw. unit of the Norton Co., Worcester, Mass.

SHELL TURBO OIL

Currently, the U. S. Navy has first call on Shell's entire production of marine turbine oil

SHELL

Series Capacitors—Where Place? How Big?

Preliminary Information*—III

By S. LUBIN
Engineer, REA Technical Standards Division

When analyzing a system prior to installation of series capacitors, the following information should be on hand:

1. A map of the system showing:
(a) Transformer sizes and reactances of large transformers.
(b) Wire sizes, lengths and phasing.
(c) Distributed and large concentrated loads under peak and light load conditions.
2. Data on loads with high peaks of short duration:
(a) Maximum kva.
(b) Power factor at peak current.
3. Maximum system peak kva.
4. Normal system demand.
5. Type and location of existing voltage regulators.
6. Voltage drop study of the system at full and light loads.
7. Power factor of system at full load and at light load.

Plot a diagram, as illustrated below, showing the voltage gradient along the system under consideration for full load and for light load periods.

"Percent voltage drop" is the ratio of voltage drop at any point to voltage at the source, expressed in percent.

"Percent voltage variation" is the difference between percent voltage drop at full load and at light load periods at any point.

"Percent regulation" is the ratio of the voltage difference at any point between no load and full load on the system, to the full load voltage at the same point, expressed in percent.

•

Glove Test Routine Safeguards Linemen

The New England Power System has established a routine for repairing damaged rubber gloves following ten months' experimental and test work in the Providence, R. I., laboratory of the Narragansett Electric Company under the direction of G. S. Burrill, supervisor of the latter's distribution substation department, and approved by the system's electric standards committee (C. N. Thomas, chairman) and J. P. McCann, safety manager of the system. The "Shaler type" patch is used, details of which have been previously published.

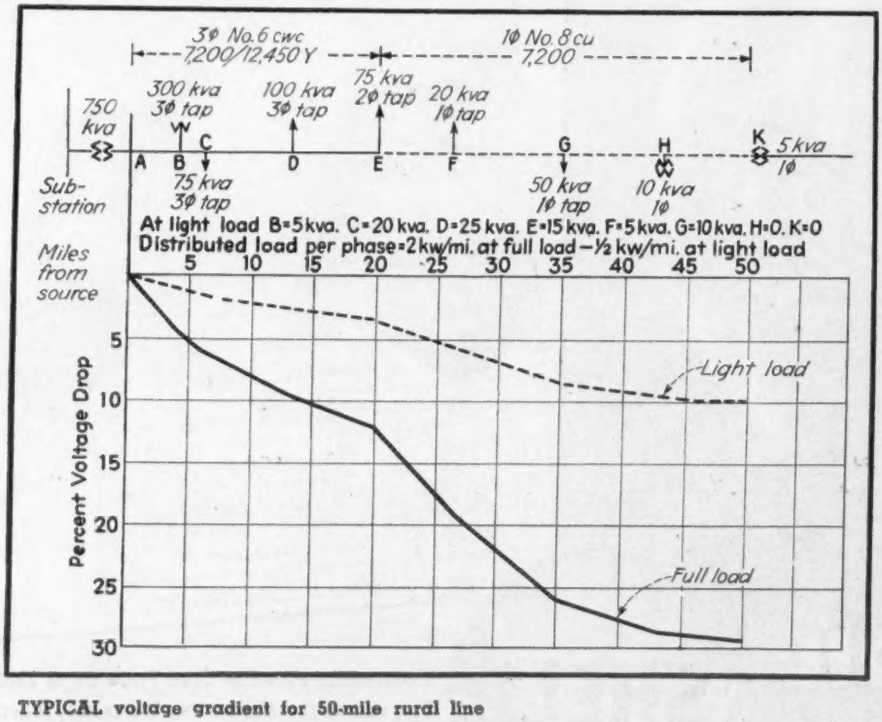
In the New England Power practice, over ten years' experience in handling about 950 used gloves per month, the average working life of all gloves in the southern district has been about twelve months. It is believed that many additional months' life will be realized from patched gloves if worn and used in the regular manner.

On this system the handling routine is extremely comprehensive and is summarized below. All new gloves passing the acceptance test are paired and numbered serially (even numbers for right hand and odd numbers for left hand gloves). Each pair is then sealed in a separate pasteboard box, the seal being marked with the numbers of the inclosed gloves, date of test and initials of the tester. A record card shows the manufacturer's name, order number of purchase, size and assigned number, together with test voltage applied and milliampere leakage. Delivery follows to the stores department for issue. The record cards are filed in the testing laboratory under the heading "Gloves in Stores." No glove can be issued more than two months after a test date without a retest.

CLOSE-UP of typical patched glove: left, outside surface; right, inside area

Each man issued gloves receives one pair for field use, a second pair being sent to the testers, with a memo of all four glove numbers. At the test "lab" the record card for the gloves is removed from the stock file, the assignee's name entered with date of issue and card transferred to the active file. The alternate pair of gloves is held for issuance at the next exchange period. The man receiving rubber gloves is also given a pair of leather gloves or keepers to be constantly worn over the rubber gloves to protect them from mechanical injury.

All rubber gloves in use are returned to the testers monthly in exchange for the alternate pairs which have been tested. The returned gloves are inspected for surface blemishes such as cuts, punctures, blisters or aging cracks, any of which may warrant condemnation. Washing with soap and warm water and antiseptic bath rinse follows. Next they are electrically tested under A.S.T.M. specifications (10 kv. for three minutes), maximum current leakage allowed be-

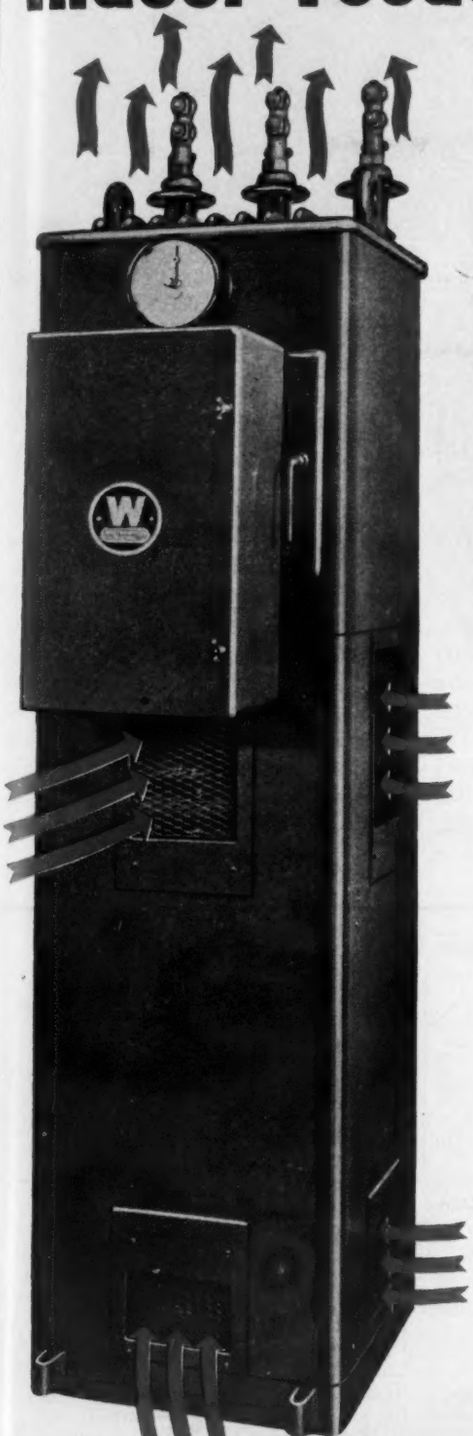


TYPICAL voltage gradient for 50-mile rural line

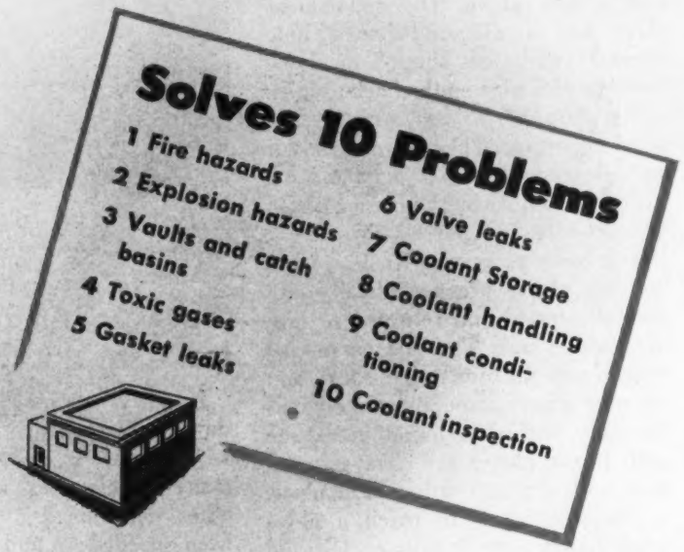
* This series began in the April 17, 1943, issue of "Electrical World."

NEW AIR-COOLED

Indoor Feeder Voltage Regulator



New Type SA Induction Regulators are designed for indoor service on 2400-volt, single-phase feeders carrying up to 300 amperes, and 4800-volt feeders carrying up to 150 amperes. Applicable also to 3-phase, 3-wire and 3-phase 4-wire systems.



Now you can afford narrow-band voltage regulation even on low-income feeders. Sensitive but sturdy, the new Westinghouse naturally air-cooled Type SA regulator requires only a minimum of attention and infrequent inspection.

Installation and maintenance cost is low, too, because of simplified basic design. No need for catch basins, fire vaults, or coolant storage and conditioning equipment.

Installation is merely a matter of attaching the leads to the clamp type bushings, because the SA Regulator is complete and entirely self-contained.

For detailed description of this regulator, write for free booklet, B-3080. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

J-10210

Westinghouse

VOLTAGE REGULATORS

ing 10 ma. Those passing the test are dusted inside with powdered soapstone or talcum and boxed and sealed as when new. The glove numbers, assignee's name, date of test and tester's initials are marked on the seal. The completed record card shows date received for test, applied voltage, ma. leakage, date of reissue and tester's initials.

Gloves failing to pass are replaced with a new glove. The condemned glove has a diamond-shaped hole about 1¼x3 in. cut about 1 in. down from the cuff edge on the back to identify it as unfit for use around electrical apparatus. The record cards for such gloves are marked "condemned," with date and cause, then transferred to a "condemned gloves" file.

This routine assures each worker that his gloves are periodically and carefully tested and returned to him in a sealed box. The box cannot be opened without breaking the seal, and the man whose name appears on it is the only one who should break the seal. Boxed gloves are always stored in a cool, dry and rather dark place.

The practice is to patch a glove immediately after it fails on test and to reissue it to the man to whom it is assigned. No hole or tear which cannot be cut out with a 0.5-in. round steel punch is patched. Usually a 0.25-in. steel punch is employed to cut away charred or torn rubber. A glove is not restored to service with more than two patches, and patches are confined to the back of the hand and the cuff. Where the condemning puncture is below the diamond cut, a third patch may be made and the gloves made available for acid handling, fireproofing transmission cables, washing cars and other suitable mechanical work. (Methods of conserving rubber safety aids were outlined briefly in ELECTRICAL WORLD, September 19, 1942, page 90).

•

Analyze Causes of Transformer Failures

Distribution transformer failures and their causes experienced by eight member companies of the Wisconsin Utilities Association during 1940 have been tabulated and analyzed by the Service Operations Committee of the Association Findings and are summarized in the table (shown at right) taken from the committee report.

SPECIAL KNIFE for gasket cutting is made from 1-in. hacksaw blade. Gasket is laid out and then cut on a revolving wheel

Gasket Cutting Idea for Circular Parts

It devolves upon the transformer shop of Tacoma City Light, of which J. V. Mollett is chief, to cut a great many circular gaskets for that and other departments. This chore has been speeded up and made easier by a rig that Mollett has put in operation. A wooden disk 3 ft. in diameter was made out of ¾-in. plywood and mounted on the end of a horizontal shaft, like the chuck on a lathe. The wheel is driven through a pulley mounted on the side opposite that shown in the accompanying illustration. Power is supplied through a belt by a 1-hp. portable unit used for general purposes around the shop.

Gasket material is mounted on the face of the disk with heavy tacks. As the disk revolves the center is readily discernible. By simply measuring off the desired radius and then holding a pencil against the material, the circles can be quickly and accurately drawn. A bench drawn up close to the face of the disk facilitates this. The gasket is next cut by holding the point of a sharp knife against the circles. Just any knife will not do, as Mollett found out. He had to make one, and after several trials he succeeded, using a heavy hacksaw blade about 1 in. in width.

Distribution Transformer Failures and Their Causes

Company	A	B	C	D	E	F	G	H
No. transformer failures	238	308	397	....	21	32	11	90 (1)
Rural percentage of total transformers in service	..(2)	54	63	....	25	56	2	0.017
Urban percentage of total transformers in service	....	46	37	....	75	44	98	0.002
Lightning	60	114	241	..(3)	4	70 (4)	6	...(3)
Overload	31	36	....	....	13	30 (4)	2	...(3)

Other Causes

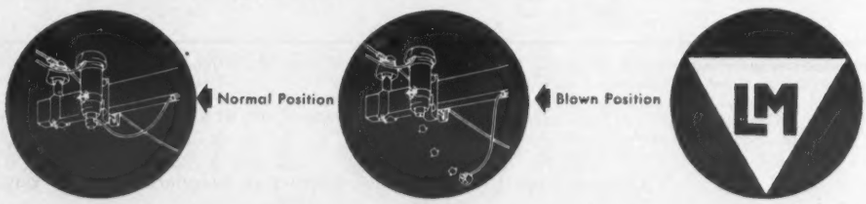
Company A		Company B	
Defective material	75	Low oil	11
Leaking or syphoning of oil	30	Moisture	32
Knocked off pole	20	Sec. and service faults	46
Short circ. in sec. system	18	Lead and terminal faults	32
Miscellaneous	4	Other causes	37

Company C — Includes overload — 114 Company D — None listed.
Company E — Shorted secondaries, 2; cause unknown, 2 Company F — None listed.
Company G — Secondary short, 1; unknown cause, possibly old age, 2
Company H — Traffic accidents, wind and secondary short are other causes.
Explanatory Notes:
(1) Rural 95 percent, urban 5 percent.
(2) Ratio of total failures to transformers in service in 1940 was 1.45 percent.
(3) Probably 90 percent or more of failures due to lightning. No accurate record available.
(4) Approximately. These are percent values.
(5) Rural — Lightning 90 percent overload and other causes 10 percent.
Urban — Lightning 30 percent overload and other causes 70 percent.

Actual Size

only L-M heavy duty lightning arresters have the ISOLATOR*

Any lightning arrester may become damaged in service at some time during performance of its duty. If it does, you would like to be sure that the damaged arrester cannot lock out a feeder. You would also like to be able to locate the casualty easily, quickly, for replacement. • All L-M Lightning Arresters — and only L-M Arresters — come equipped with the ISOLATOR*, the circuit clearing device that will automatically disconnect the arrester should it become damaged, and will indicate at the same time, visible from a distance, that the arrester has to be replaced.



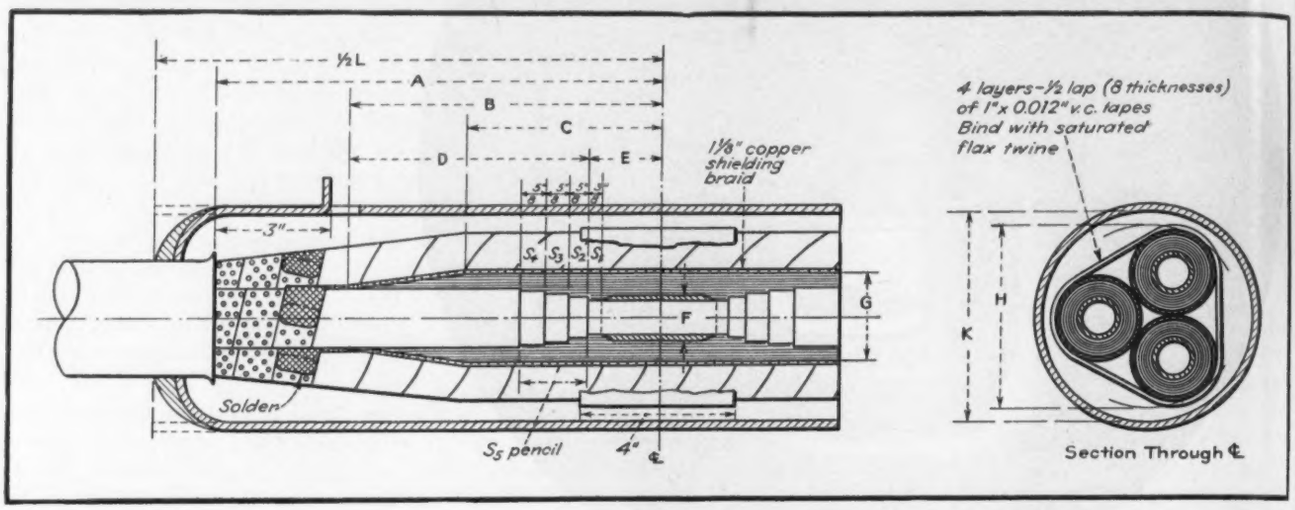
LINE MATERIAL COMPANY

* Patented

HOW TO CONSTRUCT*

10-15-KV. CABLE JOINT

For paper-insulated, shielded, three-conductor cable a cable joint is made according to instructions in jointing procedure and following dimensions for respective conductor sizes, using the listed materials



Cable Data			Connector Size (Note A)	Joint Dimensions — Inches													S5
										G		H					
Operating Voltage	Paper Insulation, In.	Cond. Size, AWG or Mcm.	Sector Cond.	A	B	C	D	E	F	11,000 Volt	13,000 Volt	11,000 Volt	13,000 Volt	K	L	Lead Sleeve Overall, In.	Length of Pencil, In.
Grounded		1/0	1/0	10	7 1/8	4	5 3/4	1 3/8	0 504	1 1/4	1 3/8	2 77	3 05	4	23	23x4x1/8	1
		4/0	250	10	7 3/8	4 1/4	5 3/4	1 5/8	0.777	1 17/32	1 21/32	3 37	3 65	4 1/2	23	23x4½x1/8	1
11,000	12/64	250	300	10	7 3/8	4 1/4	5 3/4	1 5/8	0 849	1 19/32	1 23/32	3 61	3.79	4 1/2	23	23x4½x1/8	1 1/4
and	and	350	400	10 1/2	7 5/8	4 1/2	5 3/4	1 7/8	0 986	1 3/4	1 7/8	3.85	4 12	5	24	24x5x5/32	1 1/4
13,000	14/64	500	550	10 1/2	7 5/8	4 1/2	5 3/4	1 7/8	1 154	1 29/32	2 1/32	4.19	4.45	5	24	24x5x5/32	1 1/4
		750	800	10 3/4	8 3/8	5 1/4	6	2 3/8	1.4	2 5/32	2 9/32	4.66	4.92	5 1/2	25	25x5½x5 32	1 1/4
Un-		1/0	1/0	10 1/2	7 5/8	4 1/4	6 1/4	1 3/8	0 504	1 15 32	1 9/16	3 24	3 45	4	24	24x4x1/8	1
grounded		4/0	250	11	7 7/8	4 1/2	6 1/4	1 5/8	0 777	1 23/32	1 27/32	3 78	4 05	5	25	25x5x5/32	1
11.000	15/64	250	300	11	7 7/8	4 1/2	6 1/4	1 5/8	0 849	1 25/32	1 29/32	3 92	4 20	5	25	25x5x5/32	1 1/4
and	and	350	400	11 1/2	8 1/8	4 3/4	6 1/4	1 7/8	0 986	1 15/16	2 1/16	4 25	4 52	5 1/2	26	26x5½/5/32	1 1/4
13,000	17/64	500	550	11 1/2	8 1/8	4 3/4	6 1/4	1 7/8	1.154	2 3/32	2 7/32	4.58	4.85	5 1/2	26	26x5½x5/32	1 1/4

MATERIAL LIST

Cable		Split Connector		V. C. Tape — 4-Yd. Rolls					1⅛" Shield Braid, Feet	Lead Sleeve	Filling Compound, Gal.	Wiping Solder, Lb.
				1/16 x 0.012" (Note B)	½ x 0.012" (Note B)		1 x 0.012" (Note B)					
Operation	Cond. Size, AWG or Mcm.	Round Cond. Size	Sector Cond. Size	11 & 13 Kv.	11 Kv.	13 Kv.	11 Kv.	13 Kv.	11 & 13 Kv.	11 & 13 Kv.	11 & 13 Kv.	11 & 13 Kv.
Grounded	1/0	1/0	1/0	2	6	7	18	21	25	See list	1¼	5
	4/0	4/0	250	2	7	9	27	33	30	of Code	1½	6
	250	250	300	2	8	10	29	35	30	numbers for	1½	6
	350	350	400	3	9	12	34	44	35	respective	2	7
	500	500	550	3	10	12	40	48	35	sizes	2	7
	750	750	800	4	12	15	48	60	40		2	9
Ungrounded	1/0	1/0	1/0	2	8	9	26	31	30	See list	1½	5
	4/0	4/0	250	2	10	12	37	43	35	of Code	2¼	7
	250	250	300	2	11	13	40	45	35	numbers for	2¼	7
	350	350	400	2	12	15	46	53	40	respective	2¾	8
	500	500	550	2	14	17	52	60	45	sizes	2¾	8

Miscellaneous materials required per joint: ½ lb. of sweating solder, 2 oz. of stearine flux, 25 ft. of 1-in. cotton tape, 25 ft. of saturated flax twine, 6 ft. of 2-in. paper stickers, 1 gal. of boiling-out compound.

Note A: For round conductors use connector same size as the conductor, see material list.

B: V.C. Tapes: Use 1/16-in. tape on Step S1; ½-in. tape on steps S2, S3, S4 and S5 (Pencil); 1-in. tape over full factory insulation. Only black, oil-packed, varnished-cloth tapes shall be used.

* Adapted from Underground Construction Standards of New England Power System

The L-M ROUND-WOUND is the only Transformer with long, round coils on a wound, cruciform core. As a result, L-M ROUND-WOUND Transformers have better regulation at all power factors, better ratio of losses, lower exciting current, uniformly high impulse strength, high short time overload capacity.

LINE MATERIAL COMPANY

Performance of △ — △ Transformer Banks*

III—Combined Single- and Three-phase Loads

By ROBERT S. SARGENT
Associate Engineer,
U. S. Engineering Office, Jacksonville, Fla.

When a combined single-phase load and balanced three-phase load are simultaneously put on a three-phase delta-delta bank, the single-phase and three-phase loads divide independently as set forth in formulas in the preceding article, but the resultant loadings are not necessarily the simple arithmetical sums of the loadings obtained above, but are vector sums, which are always equal to or less than the arithmetical sums. This arithmetical sum may be expressed as follows for the middle transformer:

$$L = L_{1\phi}\,\frac{2A}{B+2A} + \frac{L_{3\phi}}{3}\left[1\tfrac{1}{2}\left(1-\frac{B}{B+2A}\right)\right].$$

$L_{1\phi}$ and $L_{3\phi}$ represent the single-phase and three-phase loads respectively and A and B the kva. capacities of the middle transformer and one wing transformer.

This formula is accurate if, and only if, the power factors of the single-phase and three-phase loads are identical. Whenever the two loads have differing power factors, the single-phase and three-phase components must be combined vectorially. The expression does, however, represent the maximum possible load on the middle transformer.

The corresponding formula for the load on each wing transformer is as follows:

$$L = L_{1\phi}\,\frac{B}{B+2A} + \frac{L_{3\phi}}{3}\left(\frac{1.73\sqrt{A^2+AB+B^2}}{B+2A}\right)$$

This formula is accurate if, and only if, the phase angle of the three-phase load lags the phase angle of the single-phase load by 60 deg. (50 percent power factor if single-phase power factor is 100 percent), and if all transformers are the same size, and then is only true for one wing transformer. The other wing transformer will carry the vector sum of the single-phase component added to the three-phase component at an angle of 120 deg. If the three-phase load lags the single-phase load by 60 deg. and if the transformers are *not* the same size, the formula becomes an approximation, but a very accurate approximation nevertheless, the error usually being negligible. In any event, the formula represents the maximum possible load on a wing transformer.

The wing transformer connected to the leading primary phase will be the heavily loaded transformer in the example chosen above, and the wing transformer connected to the lagging primary phase will be the more lightly loaded.

It should be noted that the complete formula is *never* accurate when both single-phase and three-phase loads are present; either the load on the middle transformer, or the load on one or both wing transformers, is overstated in every case. *Although inaccurate*, it is conservative; that is, no transformer will every carry more than the formula gives, and in some cases one transformer may carry as much as the formula gives. Its use is recommended.

There is a resemblance between the behavior of a delta-delta bank and a wye-delta bank (primary neutral isolated) in that, in both cases, maximum load on the middle transformer occurs when the power factor of the three-phase load and single-phase load are equal, and maximum load on one wing transformer occurs when the three-phase load lags the single-phase load by 60 deg.

The primary feeding a delta-delta bank supplies three line currents, each one of which, by symmetry of connections, is directly proportional to the corresponding secondary *line* currents. The effect of a single-phase load, therefore, is to draw a line current from two primary phases, with no current on the third, and this is true even though all three transformers are carrying load.

*Previous installments appeared in the April 17 and May 1, 1943, issues of "Electrical World."

Trackless Ash Car

At the generating station of the City Utilities, Fort Wayne, Ind., plant of the municipal light and power utility tracks and turntables that formerly confined the travels of the ash dump cart have been done away with in favor of this rubber-tired, tricycle-mounted cart, which is now free to roam the plant basement as the operator sees fit. Besides being much easier to push, the new cart, built in local shops, gets around an epidemic of troubles with jamming of the turntables encountered with the former rail car.

Wood and Concrete Manhole Covers

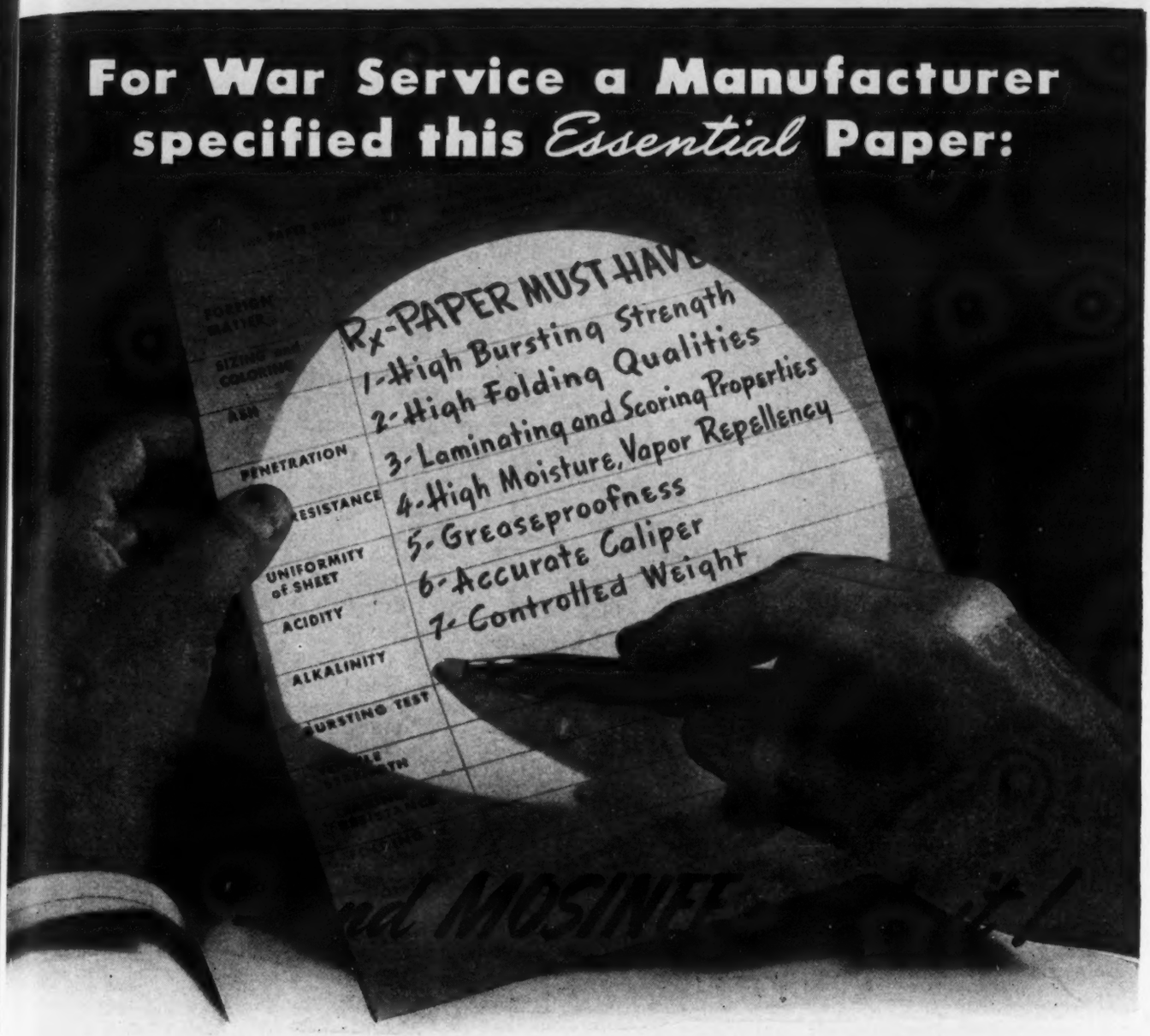
Efforts to replace critical cast-iron manhole covers and frames with satisfactory substitutes have resulted in several wartime designs. In Los Angeles County laminated timber covers set in concrete frames are being used on new sewer extensions. In Las Vegas, Nev., a concrete cover of unique design is giving good service.

The wooden covers are made up of 2x8-in. and 4x8-in. No. 1 common Douglas fir surfaced on four sides. Water-resistant glue supplemented by 20-d and 30-d nails is used to fasten the pieces together. To conserve lumber the original assembly is roughly circular. The rough block is rotated around a central pivot against a band saw blade with the saw table slightly tilted so the bottom diameter is 2 in. less than the top. For protection against decay and termites the covers are finally treated under pressure with Wolman salts.

Both cover and circular concrete frame into which it fits are designed for replacement with conventional cast-iron frame and cover without alteration once the emergency is over. If material is available, two ½-in. diameter steel-reinforcing bar hoops are desirable in the concrete frame. Frame and timber cover are set so that the latter is far enough below street grade for a wearing surface of emulsified asphalt to be applied. This prevents slivering.

Frames can be pre-cast or cast in

For War Service a Manufacturer specified this *Essential* Paper:



The paper technicians of The Mills of Mosinee are filling wide varieties of "prescriptions" for papers that "go to war."

The job *your* paper has to do may call for characteristics entirely different from those specified above . . . but whatever your need may be, you will find here the scientific laboratory and production controls of ingredients and processes . . . plus broad, practical experience . . . to assure successful performance of the specialized services now demanded of the many modern types of "essential papers."

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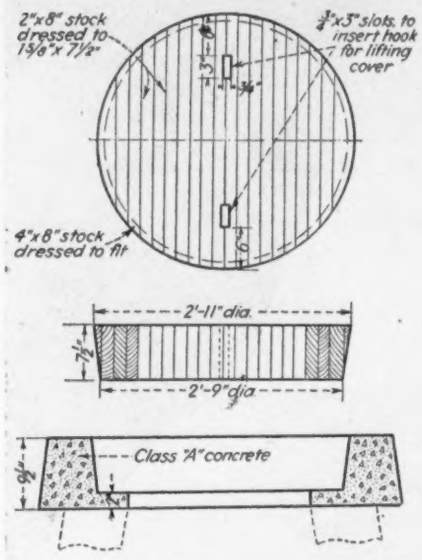
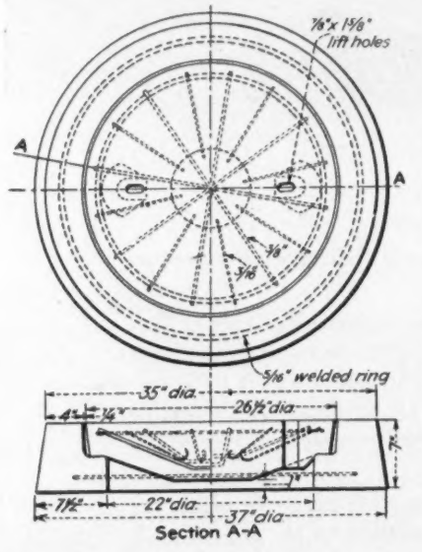
place. For the latter the cover is used as the inside form with two layers of 90-lb. roofing paper wrapped around the beveled edge. Once the concrete is set the cover is removed and the paper discarded. Unit price in lots of 100 as quoted by a lumber company is $14.20 f.o.b. mill, with $11 representing material cost, $1.90 labor and material for glueing and $1.30 cost of pressure treatment. A concrete manufacturer which has made several hundred sets of covers and pre-cast frames has quoted unit prices of $14.40 for cover and $12.50 for frames where the two are purchased together.


2"x8" stock dressed to 1⅜"x 7½"
¾"x3" slots to insert hook for lifting cover
4"x8" stock dressed to fit
2'-11" dia.
2'-9" dia
Class "A" concrete

DETAILS of a laminated wood manhole cover set in a concrete frame designed by Los Angeles County Surveyor Alfred Jones



DETAILS of reinforced concrete manhole cover and frame

The design originated with Alfred Jones, Los Angeles County surveyor and county engineer.

The reinforced concrete cover design was adopted because of fear that the timber cover would swell and thus be difficult to remove. As shown in the detail drawing, a welded reinforcing steel assembly weighing 8 lb. is made. Concrete averaging about 5,000 lb. per sq.in. under compressive strength tests is used to inclose the reinforcing. Under test the concrete cover and frame withstood a 59,000-lb. load before initial failure and 69,000 lb. before final failure. This is considered well in excess of requirements, since legal load limits would place only 16,000 lb. on the cover.

•

Car Pooling Saves One Mile in Five

To get the most in effective transportation from a given automobile, from the gasoline in its tank and from the rubber on its wheels is a problem for which every utility seeks the best solution. Sometimes the solutions appear in pretty complicated sets of rules and routines and often with dispatchers and schedules almost like public transportation systems. Perhaps in some cases these complications are necessary, but the job can be done quite simply, as witness the method employed by one utility that serves a very large area, about the half of one state.

It is necessary for various men in the technical operating departments to visit power plants, substations and other system points rather frequently. When a man, A, finds he should go, say, to the X42 power plant some day next week he calls the travel book desk and is registered. He is told, perhaps, that another man, B, has registered his intention to visit that plant or to go past it or near it next Tuesday. It is up to A, then, to arrange his work so that he can make the trip Tuesday and—this is the important part—tell B he plans to ride with him. B has no responsibility for A's transportation, all he has to do is give A the ride; A must suit his convenience to B's.

If the travel desk tells A that no one is down for a visit to the X42 plant, then A becomes first man and is registered to make the trip on a certain day. Any other man or men who want to go to the plant must then arrange with him for transportation. The man who first registers to go to a certain place at a certain time is thus, figuratively as well as literally, in the driver's seat; any others must come to him and ask for the ride. And if A, having failed to catch a ride with B on Tuesday, goes to the X42 plant on a later day that week or perhaps even the next week, he is likely to be asked some embarrassing questions by the boss.

The method is this: The man who first registers his intention to go to a certain place has his name, his destination and the date of the trip entered in a registry book. Below his name are entered those of others who have called the desk later and said that they were planning to go to or near that place. The man who is the first to register and is, so to speak, responsible for the trip, makes on his return a report of who accompanied him. The registry book thus affords not only a means for economizing on motor transportation but also a record of the savings effected.

The method has the outstanding virtue that it puts a premium on planning work ahead. Because it is always pleasanter to have others fit their plans to one's convenience than it is to fit one's plans to theirs.

Summary of Operating Department Automobile Transportation Showing Results Obtained by Trip Registry Method

Year	Month	No. of Trips Made	Average Miles per Trip	Actual* Miles (Approx.)	Probable† Miles (Approx.)	Miles Saved (Approx.)
1942...	June	120	131 7	15,812	22,893	7,081
	July	124	133 5	16,562	18,970	2,408
	Aug.	135	160 0	21,621	29,024	7,403
	Sept.	117	148 2	17,347	23,316	5,969
	Oct.	105	156 0	16,391	21,239	4,848
	Nov.	95	155 0	14,758	17,872	3,114
	Dec.	95	129 0	12,227	13,947	1,720
1943...	Jan.	105	145 4	15,275	19,524	4,249
	Feb.	103	150.0	15,425	19,728	4,303

* Actual Miles: Denotes actual miles driven with grouping trips.
Probable Miles: Denotes mileage which would have been made if trips had not been grouped.

Circuit Breakers

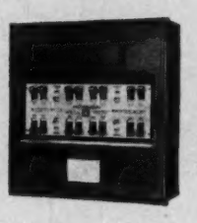
FOR EVERY TYPE OF INDUSTRIAL APPLICATION

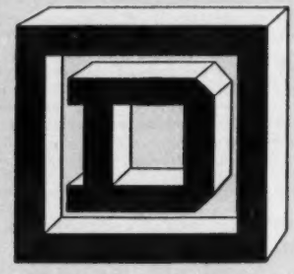
Rain-tight Multi-breakers with a variety of circuit arrangements for such outdoor applications as lights, signs, etc. Also Multi-breakers and circuit breakers in weather and dust-tight and explosion-resisting enclosures.

Industrial Circuit Breakers in standard sheet steel enclosures are available in capacities from 15 amperes to 600 amperes, up to 575 Volts. Made in 2 and 3 poles and for 3 and 4-wire systems. These devices are quick make and quick break with trip indication.

General Purpose Circuit Breakers are made with 1, 2, and 3 poles for 230 Volts A.C. and 125/250 Volts D.C. Common trip. Available in sheet steel enclosures as well as weatherproof, dust-tight and explosion-resisting enclosures. 15 to 50 amperes.

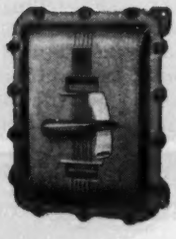
Multi-breaker Load Centers for controlling and protecting lighting and small power circuits. Made in a variety of circuit arrangements with capacities of 15, 20, 25, 35 and 50 amperes, for either 2 or 3-wire service, with individual trip.





MO Multi-breaker for use on small machines such as drill presses, grinders, riveters, staplers, saws, beaters, etc. Available in single and double pole or for 2 and 3-wire systems. 15, 20 and 25 amperes. Price is comparable to Type D switches.

Industrial Multi-breakers are available in capacities from 15 to 100 amperes, with 2 or 3 poles. Quick make, quick break with dust-resisting sheet steel enclosures; also, explosion-resisting types. Front operated with trip indication.



Weatherproof, Dust-tight and Explosion-Resisting Circuit Breakers are furnished in cast iron enclosures with gray enamel finish. Standard conduit openings in the ends. Capacities—15 to 600 amperes up to 575 Volts.

SQUARE D circuit breakers provide quick restoration of service after short circuits or overloads. They eliminate fuses and reduce maintenance cost since no replacement of parts is necessary.

Built into every Square D circuit breaker is a time lag feature which permits harmless momentary overloads to pass without causing the unit to disconnect the circuit.

Square D's line of circuit breakers is unusually complete, assuring the right unit for any given installation.

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If you have a problem which involves electrical control or distribution, you're welcome to the counsel of the nearest Square D Field Engineer. He is in constant contact with plants of every kind and size. He studies methods and applications with the idea of simplifying new jobs or doing old ones better.

There are Field Engineers in Square D branch offices in 52 principal United States and Canadian cities. Their services are dedicated to solving industry's war and postwar electrical problems.

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KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK

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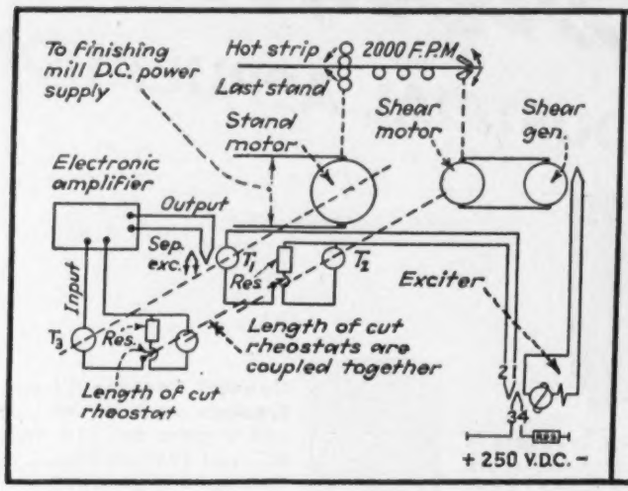
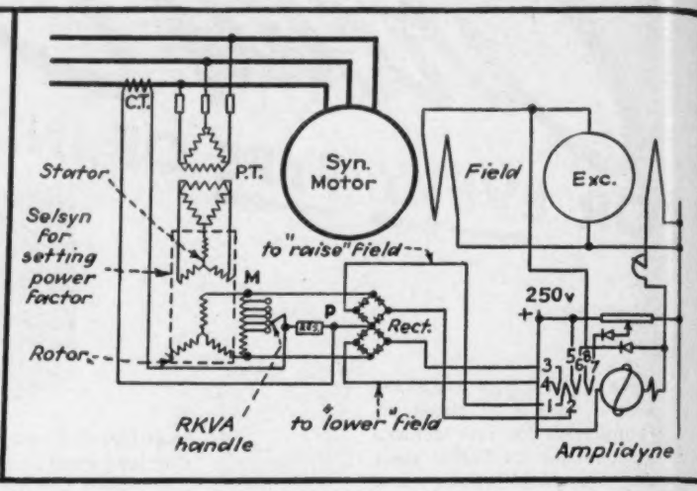
HOW THE AMPLIDYNE FUNCTIONS—II

By FREMONT FELIX, Industrial Engineering Department, General Electric Co., Schenectady, N. Y.



SPEED CONTROL—This amplidyne application on a steel-mill flying shear is a "partnership" of electronics and amplidyne.

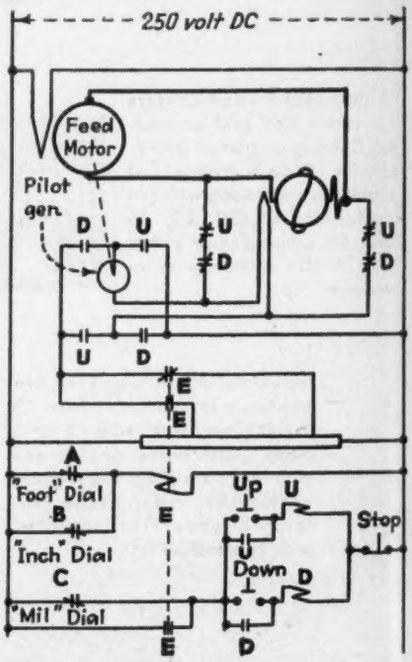
Left—Voltage difference between tachometer generator T_1 and T_2 operates on voltage field (1-2) of the amplidyne, tending to hold shear-motor speed 10 percent above that of the stand motor. The small voltage difference between tachometers T_2 and T_4 is amplified in the electronic amplifier and then is used to regulate the excitation of tachometer generator T_1. This reduces the "coarse" speed differential until exact synchronism is obtained, maintaining accurate lengths of cut.



POWER FACTOR CONTROL—Amplidyne power factor control is applied to the exciter of a synchronous motor.

Above, right—A "raise" field and a "lower" field respond to any unbalance in the preset phase of a selsyn and tap-changer combination. Maximum and minimum limit fields become effective when excitation limits are reached. Motor excitation is raised by control field (1-2) and lowered by control field (3-4). Excitation range is maintained between two values: maximum limit guarded by control field (5-6), minimum by control field (7-8). This control holds either constant reactive kva. or constant power fac or or a combination, giving, at light load, lagging reactive kva. and, at higher load, leading reactive kva., increasing with load.

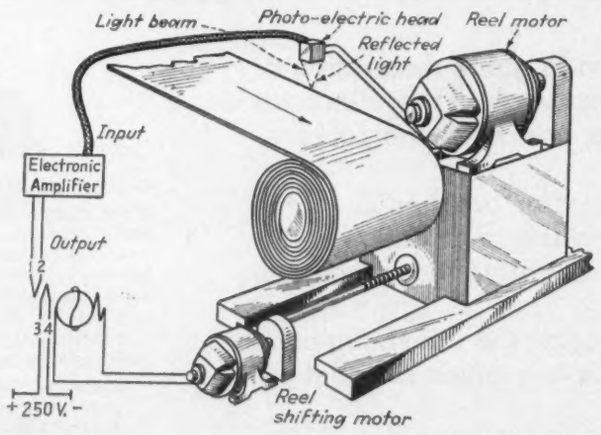
Among the control functions of the amplidyne are: (1) Speed control, as for a steel mill flying shear; (2) positioning in motion, as for side-register of a paper machine; (3) power-factor control, as by adjustment of field excitation on a synchronous motor; (4) positioning to rest, as by regulating speeds of the feed motors; (5) power control (by positioning), as in regulating power by moving furnace electrodes; (6) speed control with current limit, as in speed regulation of a single-motor paper-machine drive; (7) voltage control with current limit, as during acceleration, deceleration, plugging and stalling operations of a power shovel. These functions utilize electronic, electrical, and mechanical devices. Two other functions, namely, voltage control and current control, were outlined in conjunction with the operating principle of the amplidyne in "Electrical World," May 1, 1943, page 74.



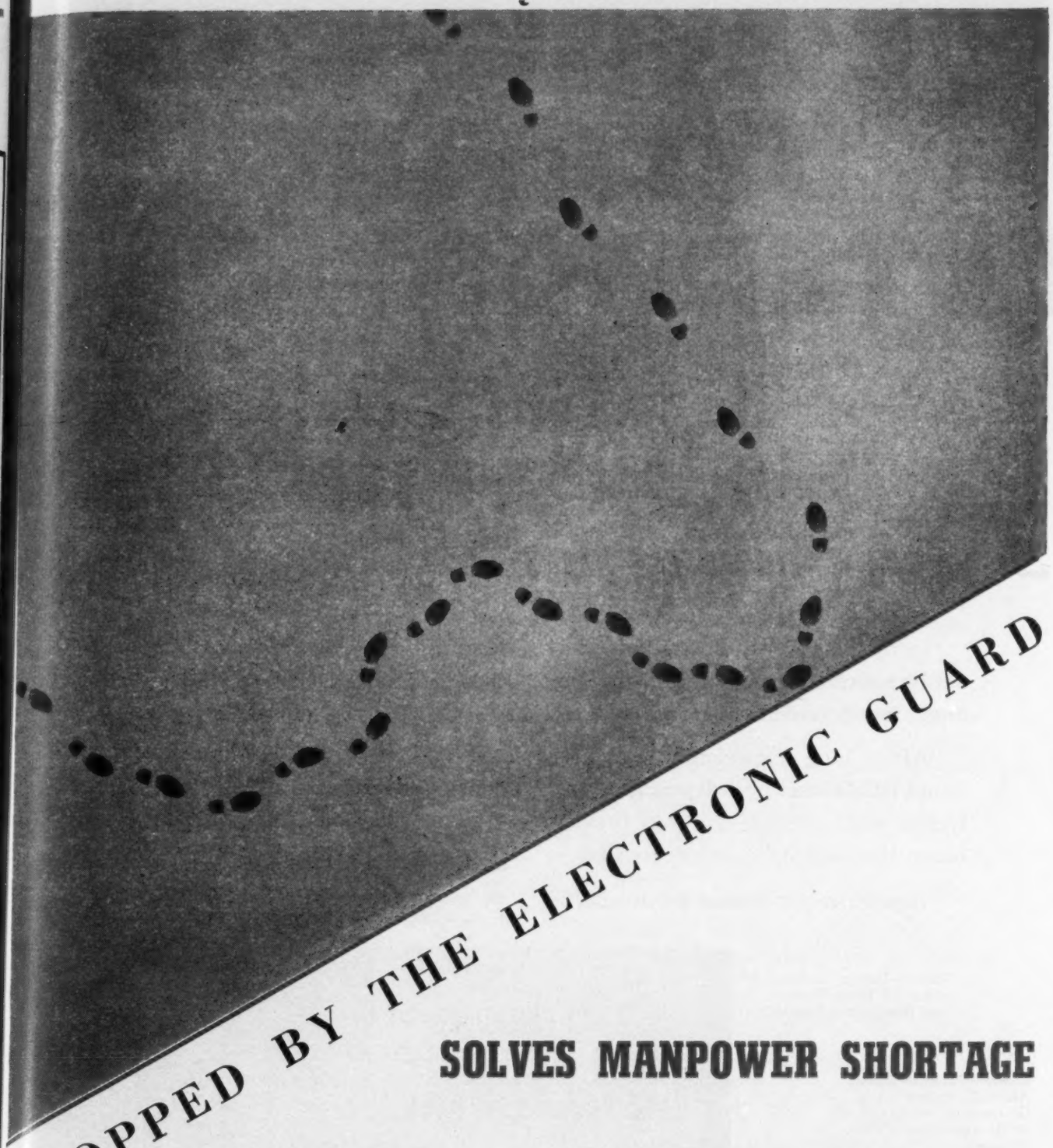
POSITIONING TO REST—Mechanical signals are translated into desired position changes.

Selsyns and other devices are used in amplidyne positioning control. On a boring mill, for example, precision limit switches are combined with potentiometer voltage standards. The signal sequence is fed to the excitation of the amplidyne, which then maintains the correct speeds of the feed motors. Limit switches A, B and C are set for preselected positions, respectively in feet, inches and mils, of the boring mill heads. When switches A and B are tripped, they set up, through potentiometer taps, a voltage which is compared with a pilot generator voltage. Any voltage difference modifies the excitation of the amplidyne, which in turn modifies the feed-motor voltage until the pilot generator balances the potentiometer voltage. First, a high running speed, then a very slow creeping speed are thus maintained regardless of friction. Finally, the tripping of limit switch C stops motor and brings boring mill head to an accurate stop.

A photoelectric device "watches" the position of the moving paper edge. Intensity of the reflected light is converted into an electric signal which is amplified in an electronic amplifier supplying voltage field (1-2) compared to reference field (3-4). The resultant net excitation of the amplidyne changes from positive to negative and vice versa in accordance with the variations of the light signal. The reel-shift motor supplied by the amplidyne thus rotates in one direction or the other to shift the reel and maintain the edge of the paper in the correct position.



POSITIONING IN MOTION—Positioning of material speeding through a machine; side-register of a paper machine is typical.



STOPPED BY THE ELECTRONIC GUARD

SOLVES MANPOWER SHORTAGE

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"In flying, failures of any kind cannot be tolerated. Every part of the ship must function correctly at all times.

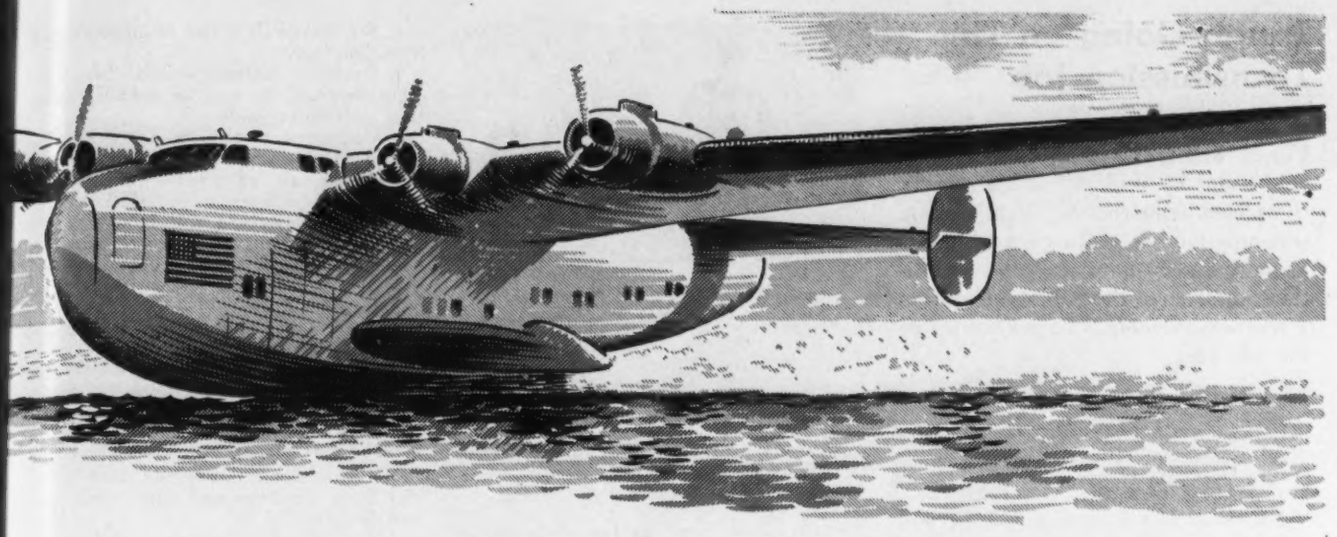
"After long experience we have found BUSS fuses give dependable protection when needed—yet they prevent blows that might be called needless.

"Hence, in our planes we use BUSS Aircraft fuses—and in our shops and hangars we use BUSS Super-Lag fuses because we have found that they likewise save us many delaying interruptions of electrical service.

"In our opinion, BUSS fuses measure up to the high standards of protection we have set here at PAN AMERICAN."

Right—Hangar Installation of Buss Super-Lag Renewable Fuses.

Below—Panel of Buss Aircraft Fuses on a Grumman Widgeon (little sister ship of the Clipper).



You, Too, Can Eliminate the Costly Nuisance of "False Alarm" Blows

Pan American's experience is typical of thousands of others, which proves that it isn't necessary to suffer from useless shutdowns caused by needless opening of protective devices. Properly installed BUSS fuses can be forgotten.

As for BUSS Super-Lag fuses—the experience of thousands of plants throughout all industry has proven time and again that by using them you can obtain trouble-free protection at a lower overall cost than with any other renewable fuse or mechanically operated device.

They require no maintenance or periodic inspection. They don't open needlessly. If one opens, you know there is some fault that needs correction.

Here is Why BUSS Super-Lag Fuses Greatly Reduce or Entirely Prevent Needless Blows

The fuse case is designed to insure good contact on the link, even when the fuse is renewed by an inexperienced person—and it is so designed that vibration or heavy overloads or the constant heating and cooling of the fuse will not permit poor contact to develop. Thus, excessive heat which causes fuses to blow when they should not is prevented.

The fuse link used is the famous "BUSS SUPER-LAG." It has lag-plates attached which give it a long time-lag so that unusually heavy starting currents or other harmless overloads will not cause the fuse to blow.

And Here is How to Solve the "Shutdown Problem" in Your Own Plant

Pass the word along that all purchase records dealing with circuit protective devices should be immediately changed to call for BUSS Super-Lag Renewable fuses. Then, as fuses are replaced or new installations made, your plant will automatically get the benefit of the carefree, trouble-proof protection that BUSS Super-Lag fuses give.

BUSSMANN MFG. CO., University at Jefferson, St. Louis, Missouri, *Division McGraw Electric Company*

WHY BUSS FUSES DON'T BLOW NEEDLESSLY

10 FEATURES
in the design of the FUSE-CASE help make it possible..
PLUS
The SUPER-LAG
development in the FUSE-LINK completes the job.

BUSS Super-lag FUSES

Sold Through Wholesalers

Tough Going on This Transmission Job

To serve an army camp the Pacific Power & Light Company had surveyed and by mid-March had nearly completed construction of a 16-mile transmission line in mountainous country under snow and other conditions that make the job stand out as a real achievement. Characteristics of the line are:

Load—1,500 kw.
Length—16 miles.
Conductor—No. 6A CW-C (bought from surplus stocks of private utilities).
Spans—800 to 900 ft.
1,500-kva., three-phase transformer.
1,500-kva., 11-kva. step regulator. (Will use full range of regulator—voltage regulation 20 percent).
Voltage—22 kv.

The line was surveyed in December and January in blizzard weather at temperatures from 10 to 20 deg. above zero and in 5 to 6 ft. of snow. That finished, the construction schedule called for building the line in one month after materials were in.

Getting the material in was a problem calling for careful planning and much determination and fortitude on the part of the crew of 30 men. Only one eight-hour shift out of the 24 could be put in on the job, and much

MEN, equipment and materials were brought to the vicinity of the transmission line by means of scooters operating on a logging railroad

additional time was necessarily spent getting to and from the work. No permanent camp on the line was practicable. The only access to the territory was by logging railroad and the men and materials were transported by scooters, as were the 40 to 45-ft. poles and other materials.

Coming to points nearest the work, materials were unloaded from the scooters and then hauled to the line by tractors. Then each pole had to be snaked to its location by teams or Caterpillars. The men floundered in as best they could on snowshoes, skis

ROD MAN on surveying party and his shoveling helper

or just plain feet. As far as possible, the existing sketchy forest roads were used to get materials from the railroad to the line, but these had first to be cleared of snow by bulldozers.

Every hole had to be barred in 3 ft. of frost and the frozen material tamped and wedged back in as well as possible. But after the thaws come it will be necessary to go back and straighten every pole.

Construction of the lines comes under the jurisdiction of H. H. Schoolfield, general superintendent Pacific Power & Light Company, and D. R. McClung, assistant general superintendent. C. S. Knowles is construction superintendent on the job.

•

Maintenance Guide for Electric Motors*

The following suggestions for the effective maintenance of electrical motors are made in a recently published report of the maintenance committee of the International Association of Electrical Inspectors.

Wherever specific maintenance instructions for a particular motor are available, they should be followed closely. In the absence of such specific instructions, however, the following periodic checks should be made. These are based on average conditions with regard to severity of duty and dirtiness of location. The frequency of the inspections can be varied to suit actual plant conditions.

Weekly Inspections, Operations

1. Examine commutator and brushes.
2. Check oil level in bearings, but do not over-lubricate.
3. See that oil rings turn with shaft, and note any excessive end play in shaft.
4. See that shaft is free of oil and grease from bearings.
5. Examine starter, switch, fuses and other controls, as well as ground connection and motor leads.
6. Open-type motors in dusty locations should be blown out thoroughly.
7. Check air gap between rotor and stator. The difference in width of gap around circumference will indicate extent of wear on bearings. This check should be made weekly on motors operating with excessive belt tension; otherwise check air gap semi-annually.
8. Start motor and see that it comes up to speed in normal time.
9. Check motor and bearing temperature under actual load conditions by feeling with hand.

Semi-annual Inspections, Operations

1. Clean motor thoroughly, blowing out dirt from windings and wipe commutator and brushes.
2. Inspect commutator clamping ring.
3. Check brushes and renew any that are more than half worn.
4. Examine brush-holders and clean them if dirty. Make sure that brushes ride free in holders.
5. Check brush pressure.
6. Check brush position.
7. Drain, wash out and renew oil in sleeve bearings.
8. Check grease in ball or roller bearings.
9. Check operating speed or speeds.
10. See that end play of shaft is normal.
11. Inspect and tighten connections on motor and control.
12. Check current input and compare with normal.
13. Run motor and examine drive critically for smooth running, absence of vibration, worn gears, chains or belts.
14. Check motor foot bolts, end-shield bolts, pulley, coupling, gear and journal setscrews, and keys.
15. See that all motor covers, belt and gear guards are in good order, in place and securely fastened.

Annual Inspections and Operations

1. Clean out and renew grease in ball or roller bearing housings.
2. Test insulation by megger.
3. Clean out magnetic dirt that may be hanging on poles.
4. Check clearance between shaft and journal boxes of sleeve-bearing motors, to prevent operation with worn bearings.
5. Clean out undercut slots in commutator.
6. Examine connections of commutator and armature coils.
7. Inspect armature bands.

Complete Overhauls

Motors should generally be given an overhauling at intervals of five years or so, normally, or, if the service is more severe, more frequently. Such a practice is beneficial in avoiding breakdowns and in extending the useful life of the equipment.

Arc-Welding Sets

Special Considerations

The general maintenance schedule relating to motors and motor controls will apply generally to arc welding sets. Ground connections should be checked periodically. Condition of cable leads should be inspected frequently to prevent flow of short-circuit current which may load generator over a long period of time. Proper ventilation should be provided, and machines operated outdoors should not be covered with tarpaulins in such a way as to impede ventilation.

* This is the third of a series of three articles based on the March, 1943, report of the I.A.E.I. maintenance committee.

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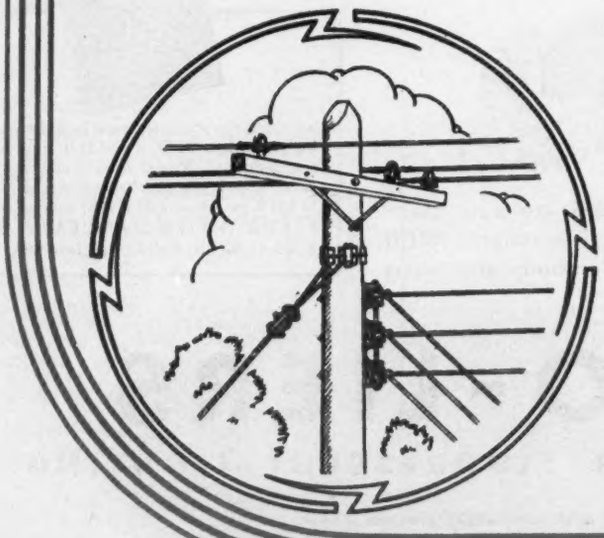

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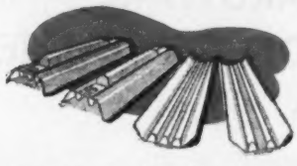
FLUORESCENT LIGHTING FIXTURES EMPLOYING EXISTING TYPES OF LAMPS ARE NOT RECOMMENDED FOR SCHOOLS, OFFICES AND SIMILAR LOCATIONS UNLESS LAMPS ARE SHIELDED FROM DIRECT VIEW
THIS CERTIFICATION IS CONTINGENT UPON EMPLOYMENT OF CERTIFIED AUXILIARIES OF OVER 85% POWER FACTOR



A war plant is no place for "post-mortems" or second guessing. Any necessary equipment must be *right!* That's why fluorescent lighting fixtures in many of these factories today bear the FLEUR-O-LIER label. *It stands for dependable lighting!*

The very backbone of the specifications that guide the manufacture of Certified FLEUR-O-LIER fixtures is *protection for the user!* For FLEUR-O-LIER specifications were written by experts of the MAZDA Lamp makers—to assure good light and good service. Over 40 leading manufacturers build fixtures following these standards.

Impartial experts—Electrical Testing Laboratories, Inc. of New York, test the fixtures to the standards—determine their right to wear the famous FLEUR-O-LIER Certification Label.

This certification includes not only individual parts, such as starters and ballasts, but the assembled unit—ready for installation. No further testing by the user is necessary.

Certified FLEUR-O-LIERS are now available to war plants on suitable WPB priorities. They embody the latest practical designs using non-critical materials. And they give the same dependable service as always.

Today it pays to be sure! Whether you need 20 feet or 20 miles of light specify fixtures wearing the FLEUR-O-LIER Label.

NEW! Write today for new booklet containing complete FLEUR-O-LIER engineering specifications. You'll want it for your guidance. With it you get the story of the FLEUR-O-LIER program and list of manufacturers. FLEUR-O-LIER MANUFACTURERS, 2126-5 Keith Building, Cleveland, Ohio.

FLEUR-O-LIERS

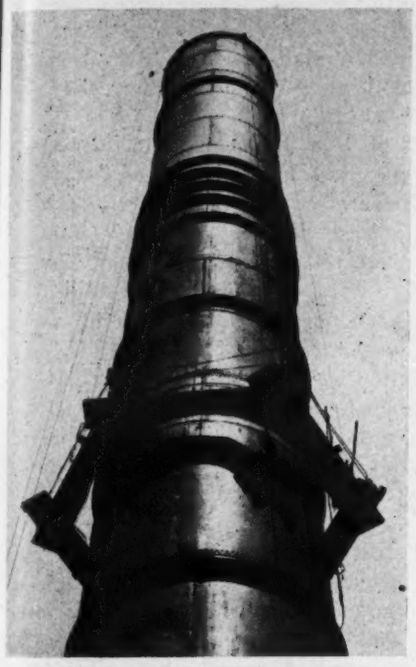
CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

Reinforcement Welded on Smoke Stacks*

Reinforcement of two smoke stacks by annular sections attached by welding was accomplished within the time allotted for another repair job on boilers and did not add to the shutdown time in a generating plant of Consolidated Gas, Electric Light & Power Company of Baltimore, Md.

The two stacks are fabricated of



ANNULAR channel sections welded to lapped sections for reinforcing of stack joints

steel and are not lined. During years of operation considerable corrosion had taken place throughout the inside of the stacks, especially at the lapped section joints. Inspection of the plate thickness indicated that the stacks should either be replaced or reinforced. Replacement of the stacks would have been a better proposition when considered from an operating standpoint. But due to the high system load it was not economical to shut down the station for the length of time required to make the replacements as well as changes necessitated in boilers and flues.

According to R. C. Fitzgerald, welding engineer of the utility company, reinforcing of the stacks was by placement of 3-in. angles longitudinally around the inside periphery at appropriate intervals. Lapped section joints were reinforced where necessary by placing annular channel sections above the joints. This latter reinforcement is shown in the illustration.

Welding was the only practical method for joining the reinforcement members. If riveting had been used, cover plates for the internal angle bracing would have had to be supplied. This would have added considerably to the weight of steel used. Also, the riveting process would have required more time and expense for field layout and drilling of rivet holes.

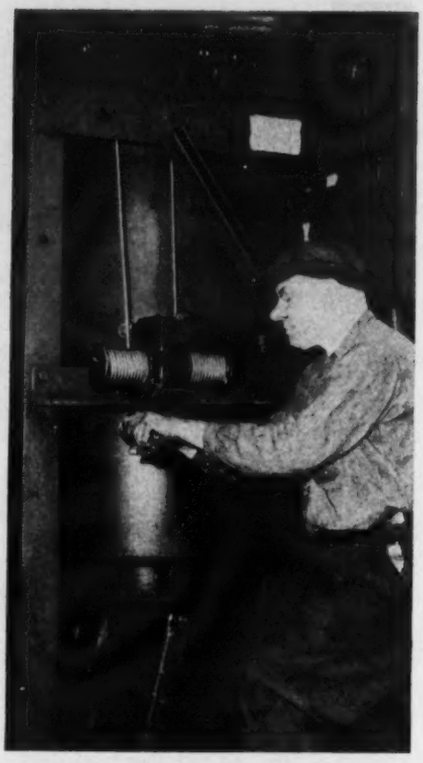
No outage costs are chargeable against this job since the repair was made during an outage for other repairs on the boilers. However, this reinforcing job is estimated to have increased the useful life of the stacks by about three years, and that fact is important at a time when power is as vital as it is today.

* Adapted from paper submitted in contest for award by the James F. Lincoln Arc Welding Foundation.

Windlass Facilitates Breaker Tank Removal

In order to lower and raise the tanks which inclose large oil circuit breakers, a windlass has been designed for attaching to the framework. Maintenance men use the small unit at the 10,000-kva., 23,000/2,300-volt substation of the Westinghouse East Pittsburgh Works.

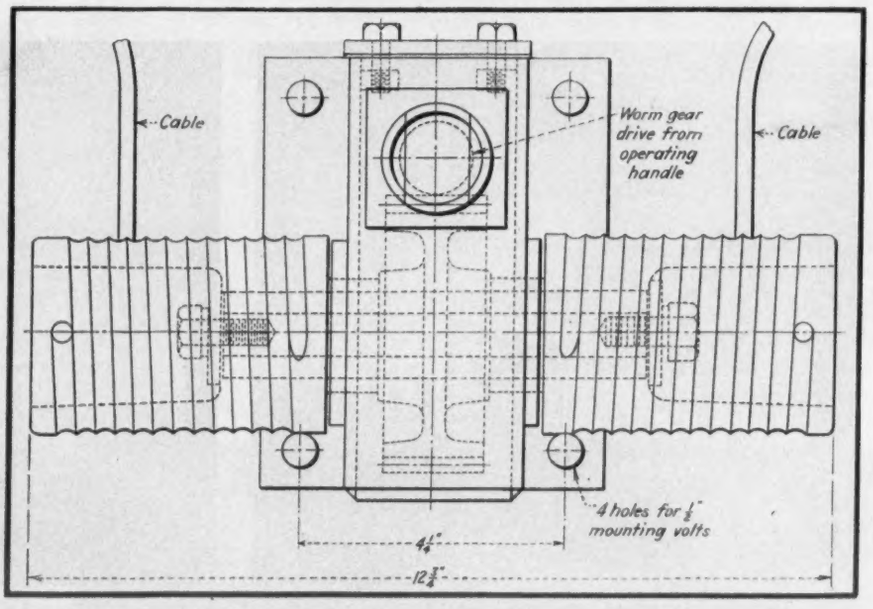
The windlass is moved from tank to tank and is attached by four ½-in. bolts to two short upright members



WINDLASS is attached to framework to facilitate lowering and raising tank of oil circuit breaker

on the frames. It has a gear ratio of 30:1 and an over-all mechanical advantage of 165:1. Both drums have a diameter of $3\frac{1}{16}$ in. Further details and an installation are shown in accompanying illustrations.

To each drum a 15-ft. length of ¼-in. wire rope is fastened. The crucible cast steel tiller or handrope has six strands of 42 wires each with hemp cores, is flexible and has 1,500 lb. lifting capacity.



OUTLINE of windlass for handling breaker tanks

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Answering Questions with Windows

Portland General Electric Company, Portland, Ore., frequently makes use of window displays to answer certain questions that vex the public. The answer then stays put in the observers' minds and they in turn are able to explain it to others.

One of the windows illustrated explains about hog fuel. It will be remembered that P.G.E. burns hog fuel in its steam plant beside the river and has there what is known as Mt. Osborne, the largest hog fuel pile in the world in full sight of everybody. Now it happens that most citizens, seeing it from a distance, take it for sawdust. During sawdust shortages and slow deliveries people using sawdust burners in their homes would keep calling the company up and pleading to be allowed to come and get even a few bagfulls, just to tide them over until they could get delivery.

This became such a problem that the window was made up as a public explanation. On the wall is a blown up photograph of the plant and Mt. Osborne, bordered with lights. On the floor is a small heap of hog fuel of the type burned in the plant, with the explanation that the material in Mt. Osborne is too coarse to work in a domestic sawdust burner. The owner can easily see that fact himself. After the window had a chance to work for awhile, there was a marked falling off in such requests.

The picture of the other window shows why so many people cannot get connections these days. It shows exactly the amount of copper wire by weight which constitutes the limit the government will allow for any one connection. This is explained on the placard on the coil. People with ideas about building, or buying an unwired home or renting some place where there is no service, look at this very limited amount of wire and begin to do some figuring themselves as to whether they are going to be able to get service. The window saved a good many from making bad moves. Any amount of "telling" would not have begun to have the same effect.

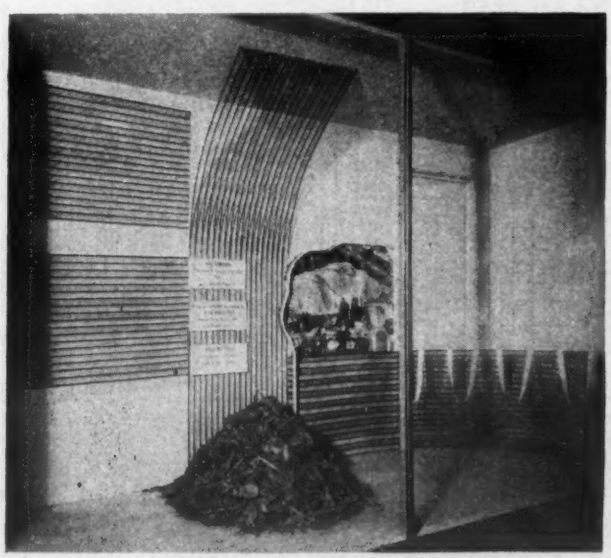
A Nutrition Program Builds Good Will

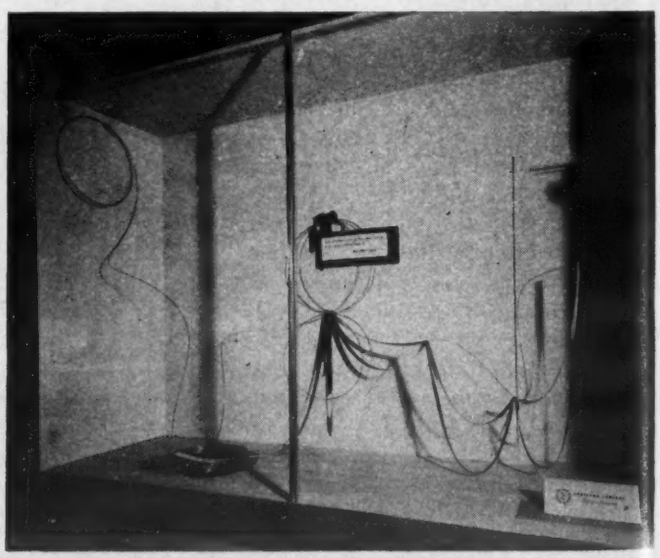
In the past cooking schools of the Wisconsin Power & Light Company, Madison, had been designed to encourage modern equipment in the home. But when the manufacture of appliances ceased the company found itself with an idle home service department and immediately set about changing its pattern of performance to participate in the government nutrition program to promote the health of war workers and their families. The transition involved some notable breaks with "tradition."

The Wisconsin company entered the program for two reasons: (1) It naturally wanted to keep its home service department intact and this plan offered a method of keeping busy for the duration while there were no appliances; (2) it was a "natural" program for a utility. The program was 100 percent for the benefit of the audience. As such it could not avoid building good will.

First step was a refresher course for company people at the University of Wisconsin, so that their later instruction to others would be approved from all angles. Although the utility paid the cost of this, other women were free to benefit from the course and several other utilities took advantage of this.

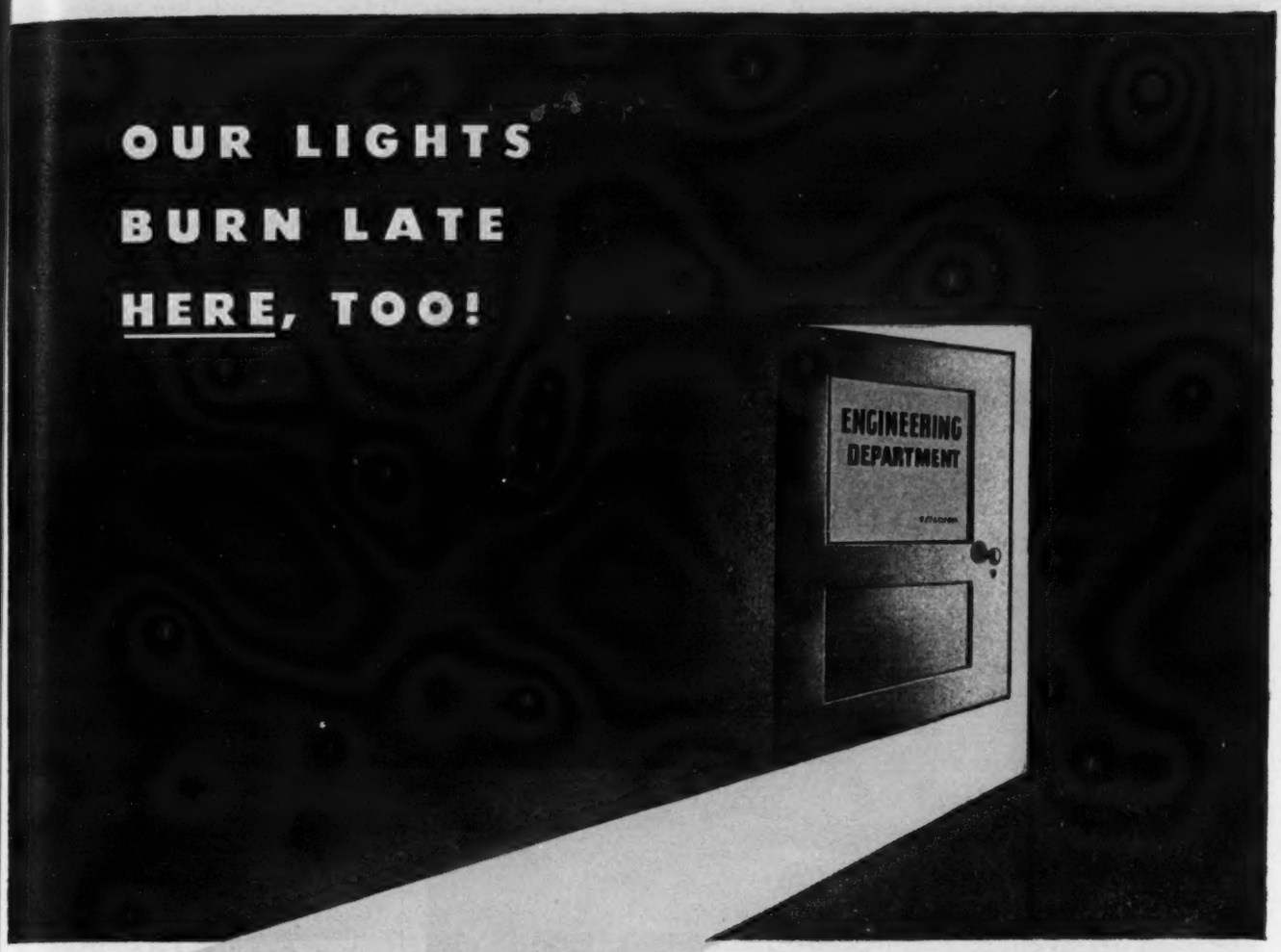
At first it was hard for some company sales veterans to understand that there was to be no discussion of appliances in the new series and no attempts to get the names of women





UTILITY show windows answer questions in the public mind

OUR LIGHTS BURN LATE HERE, TOO!



WAR'S grim needs keep our plants busy day and night, producing AmerTran Transformers, Reactors and Rectifiers. In our Engineering Department, also, the lights burn late these days. Here we are busy applying the principles we have learned in many years of transformer specialization, to the rigorous requirements of our armed forces. Much of the seed of this war-time development work will bear fruit later in the more fertile soil of a world at peace.

Some of our war research has resulted in pilot models that reveal new performance characteristics to meet the advances in the electronics and power fields. War's emphasis on economy and stamina under extreme load and climatic conditions has had its effect on our designs. Tests show losses lowered, efficiencies raised. Ease of installation has been stressed.

Today AmerTran Equipment goes to the Government and to customers with high priorities. Tomorrow we hope to serve again those good companies that cannot, for the time being, qualify in either of these categories.

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Cable Protection UNDERGROUND *FOR* Plane Protection OVERHEAD

• Here at home and all over the world wherever Uncle Sam is carrying the war to the Axis, safe and efficient operation of United Nations airports is of the greatest military importance.

• Vital "nerve centers" of these airports are the cables and wires of their power, light and signal services. Engineers have found from experience that the safest place for complete cable protection is *underground*—housed in Orangeburg Conduits.

• Light weight, ease of handling and workability make possible rapid installation. No scoring or damaging of cable sheath when pulling. No corrosion of sheath at points of contact. No infiltration of corrosive elements at any point of line. Tapered sleeve joint provides tight joints with perfect alignment of raceways.

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attending. So to begin with, home economists leaned backward to avoid using electrical appliances. No mention was made of the utility or the Westinghouse Electric & Manufacturing Company, from which much of the material was obtained.

Heads of war production plants gave their full support to the meetings because it was directed to factory people and because it had the full backing of the government. It also offered a means of combating absenteeism due to illness stemming from improper nutrition. Plant management assisted in the details of announcements, bulletins in the factories, and co-operated in other ways in getting a good crowd for the opening to hear the story.

One reason for the success of the meetings has been the fact that they have kept economic groups together. Notice the type of organizations that were reached:

4-H Club booths at fairs.
Firemen's Auxiliary.
King's Daughters.
First Aid, Presbyterian Church.
Catholic Women's Club.
Vocational Adult Class.
United Auto Workers Club.
Baptist Guild.
Junior Chamber of Commerce Auxiliary.
Royal Neighbors.
Rebeccas—East and West.
Methodist Lois Society.
Congregational Aid.
St. Paul Lutheran Aid.
Ladies Auxiliary, Brotherhood of Trainmen.
St. John's Ladies' Aid.
Washington PTA.
Ladies' Aid First Lutheran Church.
Willing Workers of St. Peter's.
Women's Auxiliary of Rail Mail.
Women's Auxiliary of Moose.
Tank Company Auxiliary.
Eastern Star.
St. Patrick's PTA.
High School Students Group.
Adams PTA.

Second reason for the success of the nutrition program was the avoidance of pseudo-scientific verbiage. It appears that practical housewives don't cotton to calorie stories. Packing of lunch boxes and common-sense solutions to cooking problems of the moment appealed to them.

More than attendance records afforded a check. In one town a nearby butcher reported that he sold four pounds of beef heart daily. The day after the meeting 20 pounds of beef heart was sold to customers.

Problems of gas and rubber shortages were soloed in the remote towns of the wide-flung utility territory by looking up retired home economists in the vicinities and hiring them to put on the lectures. Much of the

New FRIGIDAIRE campaign an outstanding success

More than 3¼ million FRIGIDAIRE booklets requested in less than 2 months!

Frigidaire's plan was announced only a few weeks ago! The second campaign advertisement has just reached the newsstands! Yet even at this early date Frigidaire's new program has created widespread interest and enthusiasm.

Frigidaire dealers hail the campaign as an exceptional good will builder. They are carrying out extensive promotions in their communities to get full benefit from the powerful appeal of Frigidaire's WARTIME SUGGESTIONS booklet. They are using it to maintain their identification with the Frigidaire business, and to build good will that will be increasingly valuable to them as time goes on!

How dealers build good will with WARTIME SUGGESTIONS

Quick to seize an opportunity, Frigidaire dealers are tying in with Frigidaire's national advertising, and are providing refrigerator users with WARTIME SUGGESTIONS booklets in many resourceful ways:

- X Giving to store visitors
- X Mailing to Frigidaire users
- X Leaving on service calls
- X Mailing to store customers
- X Giving to Home Economics classes
- X Giving to Red Cross or other groups
- X Offering in advertising
- X Distributing in cooking schools
- X Distributing through County Home Demonstration Agents
- X Offering in window displays

Every day brings thousands of requests for WARTIME SUGGESTIONS booklets from refrigerator users everywhere. Many request specific information. Others tell how proud they are of their Frigidaires and how interested they are in receiving help on today's food and refrigeration problems.

COMING! "How to make room in a crowded refrigerator" is the next timely message that will appear during May and June in Life, Ladies' Home Journal, Woman's Home Companion, Good Housekeeping, McCall's, Better Homes & Gardens, American Home, True Story and Farm Journal and Farmer's Wife, with a combined circulation of more than 27 million copies. Watch for it!

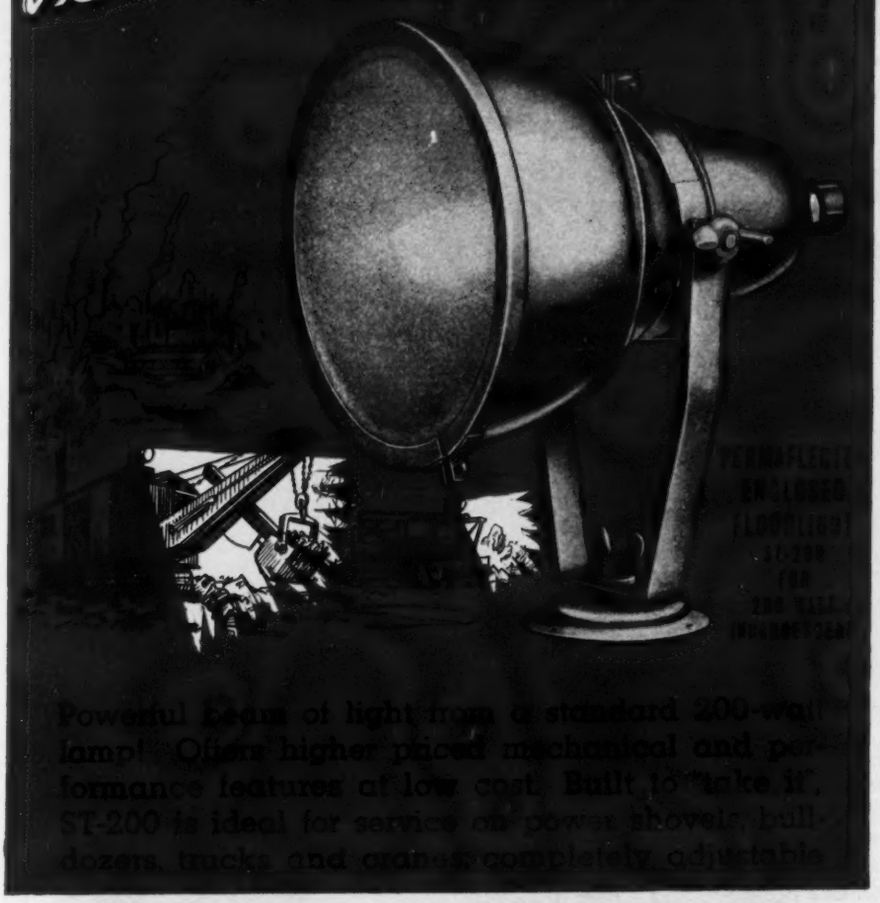
For Excellence ARMY E NAVY *in War Production*

FRIGIDAIRE Division of GENERAL MOTORS

Peacetime Builders of Home Appliances, Commercial Refrigeration, Air Conditioners

NEW LOW-PRICED

Permaflector



Powerful beam of light from a standard 200-watt lamp! Offers higher priced mechanical and performance features at low cost. Built to "take it". ST-200 is ideal for service on power shovels, bulldozers, trucks and cranes; completely adjustable

SHOCK and WEATHER-PROOFED

Adjustable! *Data!*

Permaflectors

Please rush complete data on small-wattage PERMAFLECTOR Floodlight ST-200 — *EW 5-43*

NAME.....

ADDRESS.....

CITY..... STATE.....

material could be sent by mail and cooking utensils were supplied by the local branch of the utility. Thus there was no need to travel the twelve home service girls to obscure districts.

Commenting on the effects of the nutrition program in his company, Paul De Leon, new-business manager, said: "When you promote something for your own advantage it is an uphill pull. When you do something that is purely altruistic and for the public good, as this program is, you are amazed at the co-operation and publicity that is uncapped from every one. This is one of the best good-will programs we have ever put on, and it succeeds because it is not only timely but is the most complete thing available and does a lot of good right where it is needed. With rationing coming on, there is little doubt that the interest in nutrition will very shortly reach into upper income brackets, and it may be, before snow flies again, Wisconsin Power & Light will be reaching every income group. One thing that is coming out of this war is an understanding of nutrition by everybody."

•

Home Dehydrator is Flexible, Easily Built

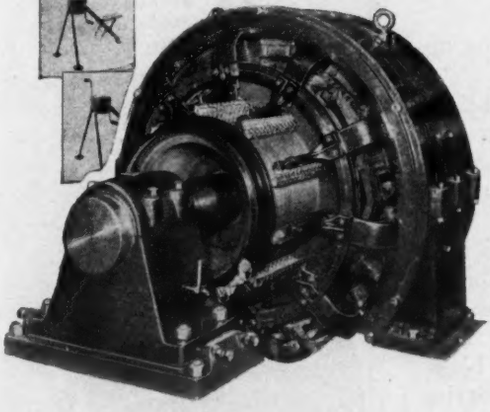
A low-cost home dehydrator that is simple to make and adaptable to varying climatic and other conditions has been designed by Thor W. Christenson of Pacific Gas & Electric Company. A bulletin telling how to make and operate the unit is being issued by the utility as a service to customers.

The cabinet can be built of plywood, fiberboard, insulating board, scrap lumber, or even from an old refrigerator box. Heating unit is any type small electric heater used in the home, or a bank of twelve 100-watt lamps.

An electric fan, while not essential, can be fitted at the top of the cabinet to speed the drying process during the first three hours. In hot climates, or where products have a high moisture content, the fan may be used alone during the initial stage.

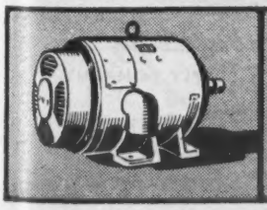
The model cabinet was built from one sheet of plywood and is 20 x 28 in. x 60 in. high. It is fitted with eight trays, spaced 4 in. apart in the

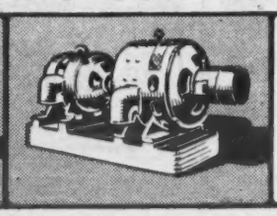
1/20th TO 1000 K.W. GENERATORS



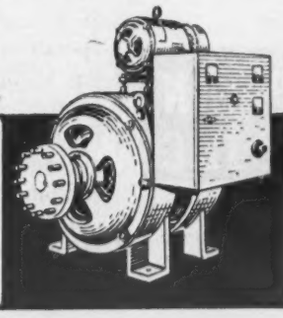
SOMEWHERE on U. S. fighting fronts, thousands of the Burke hand generator units shown above are making 1/20 of a kilowatt a very important unit of power. Somewhere in between this junior generator and the Burke 1000 K.W., D.C. or A.C. generator lies the answer to your generator problem. Perhaps you have an old reliable that should be retired, but because of the 24-hour schedule that your plant is operating under, you just cannot take the time it takes to replace it. Perhaps you are expanding and you need more generating capacity. In either case, we want you first to know Burke better, and then we want to know your problem in detail. Write for our general bulletin today.

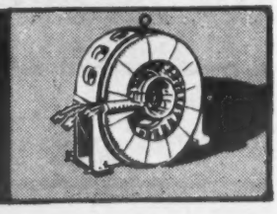
BURKE ELECTRIC COMPANY · ERIE, PA. **SINCE 1891**





D.C. Equipment to 1500 H.P. and 1000 K.W.
A.C. Equipment to 1500 H.P. and 1000 K.W.
M-G Sets to 1000 K.W.
Molded Bakelite Terminal Blocks

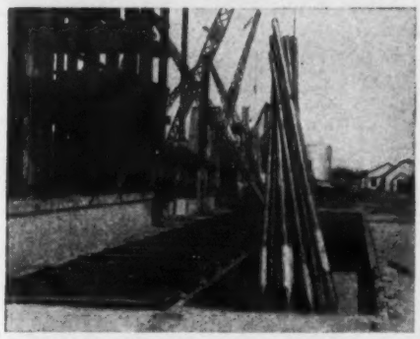




PERMATOX "A"

(A Straight Toxic Wood Preservative)

. . . an answer to the "pole shortage"



Typical full-length dipping vat for the treatment of Poles with PERMATOX "A"

The critical lumber scarcity makes it imperative to treat all new poles . . . as well as to reclaim and re-use old poles by trimming away decayed parts, then dipping, spraying or brushing the clean surfaces with PERMATOX "A" (5% pentachlorphenol in suitable petroleum solvents).

●

This treatment is also effective for cross-arms, ties, racks, crossing planks, bridge timbers and other exposed construction. It insures control of decay and attack of termites or other pests.

PERMATOX "A" is available in *economical concentrates*, (1 to 5 and 1 to 10), for saving freight costs in long shipments.

●

Furnished in Two Forms:—

DOWICIDE 7

Pentachlorphenol* crystals

PERMATOX "A"

5% Pentachlorphenol* in suitable petroleum solvents

*Manufactured by The Dow Chemical Company

Write for Bulletin

A. D. CHAPMAN & COMPANY, INC.

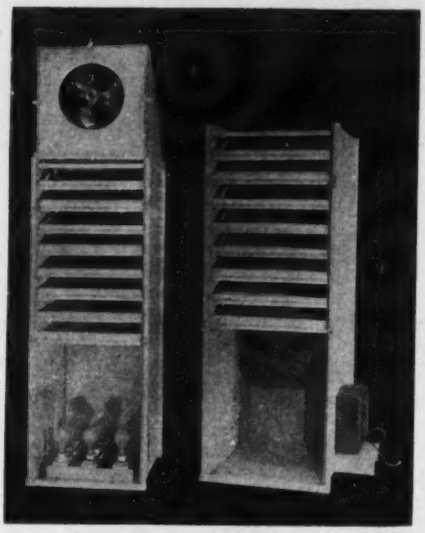
333 N. MICHIGAN AVE. *CHICAGO*

Memphis Portland

New Orleans New York

upper portion of the box. The bottom 26 in. is left clear for the heating unit.

Drying trays are simply wood frames approximately 27½ x 18 in., either wood slatted or strung with fish line. Slats are of ¼ x ¾-in. and tray frames and slides of ¾ x ¾-in. material. In slatting the trays an opening of approximately 5 in. is left at one end, and the eight are placed in the cabinet with these openings alternated from front to back to permit air to



TWO of the several possible adaptations of the dehydrator design
Heating units are (left) twelve 100-watt lamps and (right) a fan-type air heater. Any small electric heater can be utilized. An electric fan is not essential, but will speed the drying operation during the initial stage, or can be used alone where temperatures are high or produce contains a particularly large moisture content.

circulate evenly from the bottom up through the top.

When lamps, or any type heater except the fan type, are used for drying, an opening, 2 x 25 in., must be cut on each side of the cabinet near the bottom.

Vegetables are shredded and fruit sliced before they are placed on the trays, which should be covered with cloth to protect the produce. Each tray has a capacity of about 1½ lb. of wet produce. During the drying operation trays are alternated from top to bottom as required for even drying. With a normal drying temperature of from 100 to 160 deg., average drying time for vegetables is from five to ten hours and for fruits from eight to twenty-four hours. It is recommended, however, that tests be made under varying conditions.

SOLID SHANK

The Strongest Known Spoon

● Solid shank construction, originated by True Temper, is universally acclaimed by all important shovel users—railroads, mills, mines—as first in service life, utility and efficiency.

The Sturdee *Solid Shank* Spoon is forged in one piece from a solid bar of steel—blade, shank and socket are all one—no seams, laps or welds to break in service.

A chain is no stronger than its weakest link. The Sturdee Solid Shank Spoon has no weak spots. Its strength is matched and balanced. Every power, light, or communication company who has tried this spoon, now specifies it to the exclusion of any other type. To start a program that will save cost and increase efficiency, use Sturdee Solid Shank Spoons.

STURDETOOLS
a TRUE TEMPER PRODUCT

Western pattern. Sturdee Solid Shank Heavy Duty Spoon. Blade, shank and socket forged in one piece from a solid bar of steel. 13 gauge, heat treated blade. XX grade hickory or ash handle — lengths 6 feet to 12 feet.

Distributed by

JOSLYN MFG. & SUPPLY COMPANY

Executive Offices

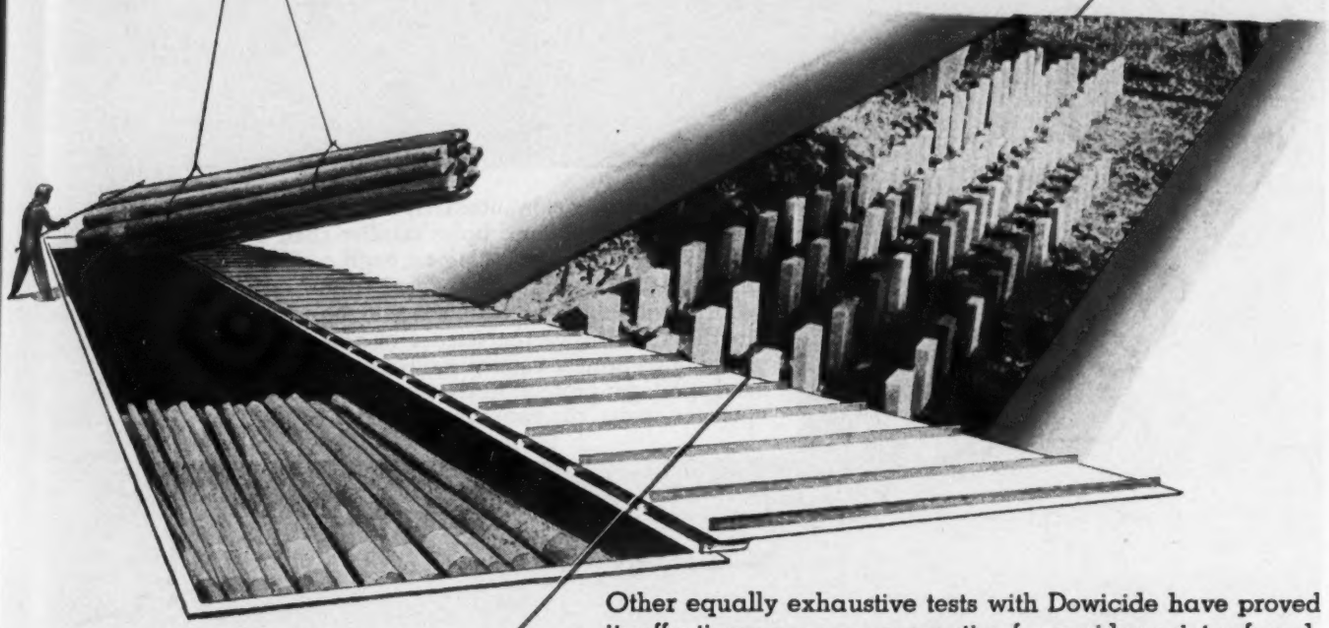
20 North Wacker Drive • Chicago, Illinois

Branches and Warehouses with Complete Stocks in Principal Cities of the United States

Graveyard for Termites

Tests conducted with Dowicide in field plots in Louisiana and Florida have sealed the doom of termites and micro-organisms which cause damage to a wide variety of wood and paper products.

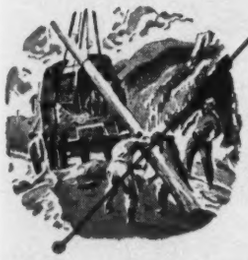
Wood products were treated with Dowicide, placed in the ground and subjected to most severe conditions. When examined—after prolonged exposure—the test pieces showed remarkable resistance to destructive influences.



Other equally exhaustive tests with Dowicide have proved its effectiveness as a preservative for a wide variety of products. In such varied fields as textiles, paints, paper and leather, Dowicide is considered an indispensable chemical product. Practically every industrial requirement for protection against the damaging growth of micro-organisms is being successfully met with one or more of the seventeen Dowicide products.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • St. Louis • Chicago • Houston • San Francisco • Los Angeles • Seattle



DOWICIDE'S USE IN POWER TRANSMISSION AND COMMUNICATIONS—Poles and other timbers for outdoor use produce longer service and require less maintenance when impregnated with Dowicide. Oil soluble Dowicide 7 and water soluble Dowicide G are both used for this purpose. Either is simple to use leaving the wood odorless, free of discoloration, completely paintable and efficiently protected from decay and termites.

DOWICIDE

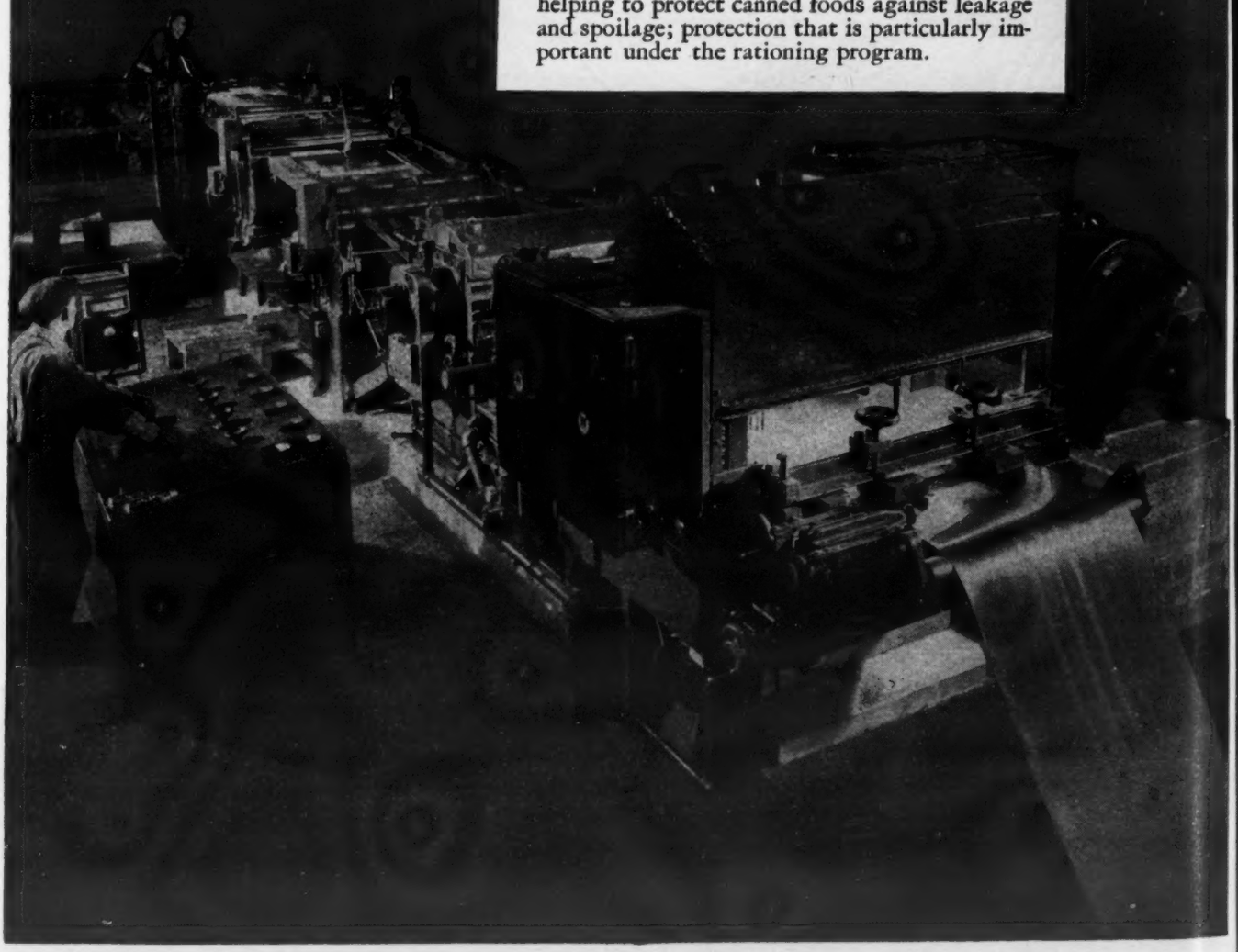
GERMICIDES AND FUNGICIDES

DOW

CHEMICALS INDISPENSABLE
TO INDUSTRY AND VICTORY

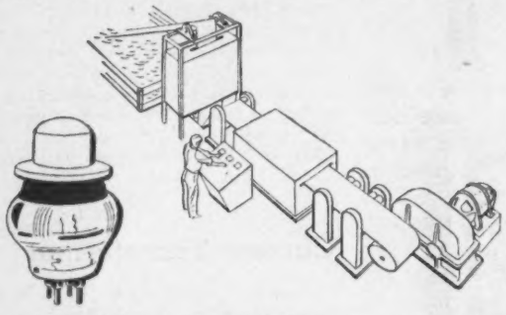
Electronics

The Pinhole Detector automatically spots, classifies and marks minute holes smaller than 1/64 of an inch in tinplate racing through a shearing line at 1,000 ft. a minute. By detecting these imperfections—most of which would be invisible to the naked eye—the science of Electronics is helping to protect canned foods against leakage and spoilage; protection that is particularly important under the rationing program.

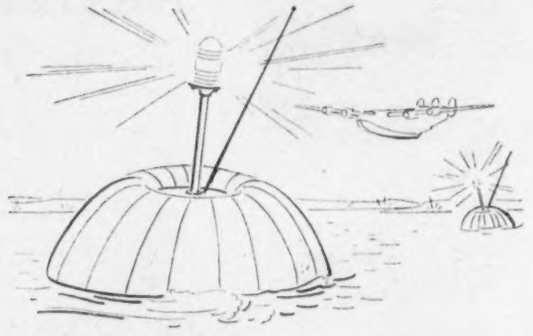


. . at Work

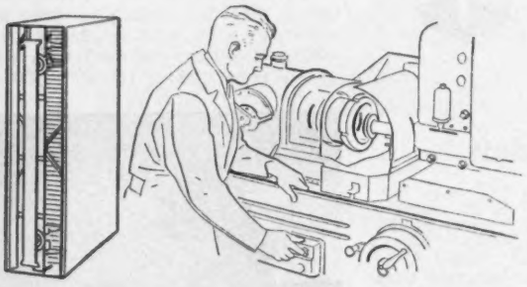
Exciting as the future of Electronics may be, it is far more than a "science of tomorrow." Electronic devices are at work *today* in practically every war industry—speeding production, improving products, cutting costs. Here are typical examples of Westinghouse "Electronics at Work."



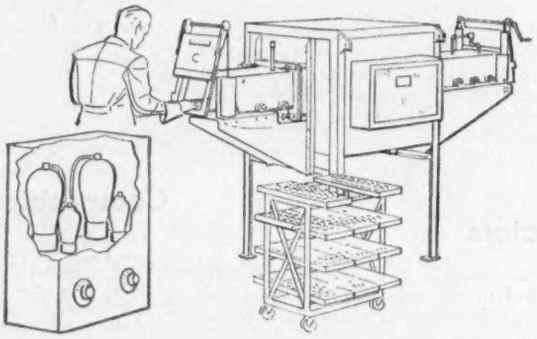
Saving Tons of Tin—Through electronic control of high-frequency induction heating, a coating of tin thirty millionths of an inch thick can now be "reflowed" to give a smooth, corrosion-resistant surface—requiring only *one-third* as much tin as previous methods.



Safe Night Landings for giant clipper planes are made possible by seadrome lights controlled by electronics. An entire landing lane can be turned on by shore radio to meet the arriving plane's requirements and guide it to a safe, sure landing, even in pitch darkness.



Removing Oil Mist created by gear-grinding and thread-grinding operations is a highly important application of PRECIPITRON—the Westinghouse electric air cleaner. By removing oil mist and returning clean air to the room, the load on air conditioning systems is reduced, oil smudge which reduces lighting efficiency is eliminated, health of operators is protected.



Heat-treating at 2000° C. can now be controlled more precisely than ever before—to insure absolute uniformity in treating metal alloys and chemicals. Minute variations in temperature activate an electronic control which increases or decreases current entering the furnace. The "Furnatron" is the most accurate control ever developed for resistance-type production furnaces.

J-91013

For further information on practical applications of Westinghouse Electronic devices, write or phone your nearest Westinghouse office, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Westinghouse ELECTRONICS

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

NEW EQUIPMENT

Electronic Meter

Designed to measure time interval between two events which can be converted into electrical impulses, new electronic time-interval meter consists of an electronic panel and a phototube with its pre-

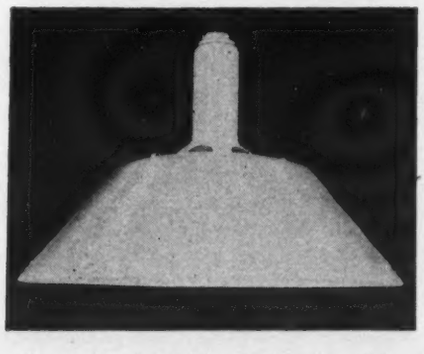
Electronic time-interval meter; operates on 115-volt, 60-cycle circuit; measurement range of time interval of a length between 0.001 second and three seconds. **General Electric Co.**, Schenectady, N. Y.

amplifier stage. A standard indicating instrument calibrated in milliseconds gives a direct reading of the time interval measured. Normal input signals consist of changes of light intensity of approximately 1.4 foot-candles falling on the phototube or the making of external electrical contacts. Accuracy is said to be 2 percent of full scale value.

•

Reflectors

New line of "Plaskon" industrial reflectors is said to use only 13 oz. of steel and units are maintained in place by a three-point safety suspension. They are supplied with fittings for mounting on pipe, box or with a strain relief cord. Manufacturer claims 75 percent of lamp lumens is directed downward; 11 percent of total lumens of bare lamp is directed toward the 90- to 180-deg. zone, making a total light output of 86 percent.

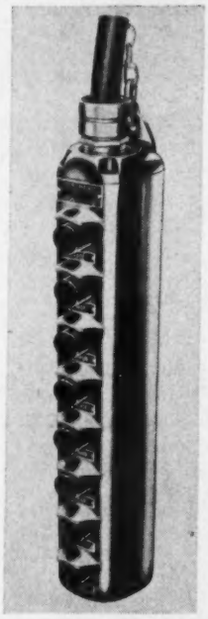


Commodore industrial reflector; sizes 15 in. and 19 in. accommodate lamps from 200 to 500 watts. (Cat. No. 1-369, 19 in., illustrated). **F. W. Wakefield Brass Co.**, Vermilion, Ohio.

•

Push Button

Designed primarily for crane and hoist operation, new push button is said to be easily adaptable to any machine where pilot or relay circuits are used. As the button is pushed in, it moves a metal cylinder to wipe over a succession of contacts. The contacts are steel balls mounted on springs stiff enough so operator can "feel" successive clicks.



Multiple-speed push button; provides up to five speeds in a single button. (Illustrated—Battery of buttons in a pendant.) **Northern Engineering Works**, 2615 Atwater Street, Detroit, Mich.

•

Composition Conduit

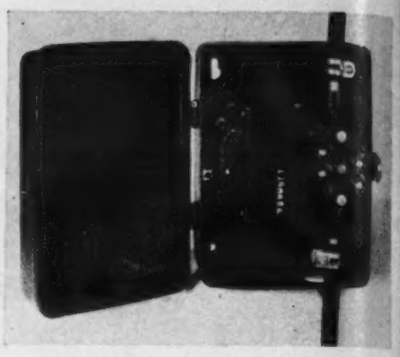
Asbestos-cement conduit; two thicknesses, for installation with or without concrete encasement, supplied with Flexcaulk coupling. **Philip Carey Mfg. Co.**, Lockland, Cincinnati, Ohio.

Asbestos-cement conduit, intended principally for cable installation, is said to be easily cut on the job and easily assembled by unskilled labor. Coupling consists of a tubular housing of asbestos-cement, to which is bonded a liner of mineralized asphalt compound, formed into a barrier-type, tapered liner. It is said to permit a flexible, self-aligning, water-tight joint when assembled with a joint-sealing compound.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Flow Switch

New flow switch for resistance welding and other applications is designed to detect the lack of proper cooling water required for adequate cooling of ignitron



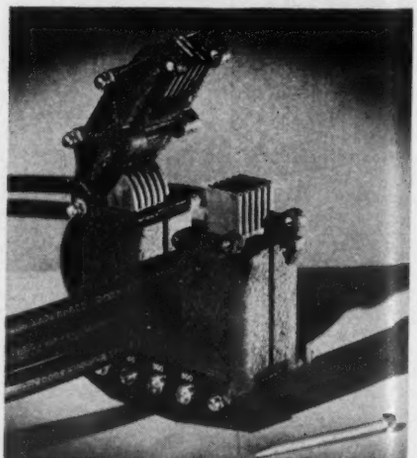
"Electro Thermostatic" flow switch; available in 1½-gal. or 3½-gal. per minute size in both a 25- or 50/60-cycle, 220/440-volt rating. **Westinghouse Electric & Manufacturing Co.**, East Pittsburgh, Pa.

tubes. The device consists of a 100-watt transformer having a one-turn secondary short circuited through a piece of high-resistance stainless steel tubing through which water from the ignitron tubes flows. Furnished with a spring mounting, said to insure against excessive tightening of switch elements, the switch is available with or without inclosing switch cabinet.

•

Current Transformer

Current transformer has interleaving laminations at core joints said to have lower reluctance and magnetizing current than with butt joints. Unit is designed for use with graphic instruments and for a 10-volt-ampere burden. All current ratios claimed to be usable with high accuracy with 10-va. ammeter on 60 cycles and with reasonable accuracy with 20-va. ammeter on 25 cycles. According to the manufacturer, the 600-amp. range gives high accuracy with wattmeter, regardless of power factor; 300-amp. range gives high accuracy above 85 percent power factor; 150-amp. range should not be used with wattmeter unless power factor is about 100 percent.



Split-core current transformer; 150, 300 and 600 amp. primary; 5 amp. secondary; insulated for use on voltages up to 440. Dimensions: 6 7/16 in. long, 6 5/8 in. high, 4 3/16 in. thick. Opening: 1 9/16 in. wide by 3 1/8 in. high. Weight 12 lb. **Erie-line-Angus Co., Inc.**, P. O. Box 596, Indianapolis, Ind.

—Like the HUBBARD AUTOGAP Lightning Arrester "Shoots Out" a follow-up arc

In Texas and other oil districts, when a well takes fire, a famous firm of oil field fire fighters is called in to extinguish the blaze. This is often accomplished by "shooting out" the blast after wreckage has been cleared and the fire confined to the smallest possible area, usually the jet emitted from the top of the casing. "Shooting out" consists of placing at the casing, a heavy charge of gelatinous nitroglycerine which, when exploded, destroys contact between the gases and the flames so that the continuous feed of combustible material to the point of ignition is interrupted. There is much more to the trick, but in principle, that is the process.

Hubbard *Autogap* Lightning Arresters employ exactly the same principle, but the "fire" in this case, is electrical, and the dissipating force is supplied automatically by the passage of the current through the arrester. When the current is forced around core "A" and through the minute clearances "B" to reach ground, the confinement and the contact with the fiber surfaces causes an explosion. The gases generated are exhausted simultaneously in opposite directions through vents. The follow-up arc is "shot out" just as the nitroglycerine explosion snuffs out a burning oil well.

For detailed data and diagrams write for an illustrated "Autogap" bulletin containing operating data, installation methods, results of tests and other pertinent information.

HUBBARD AND COMPANY

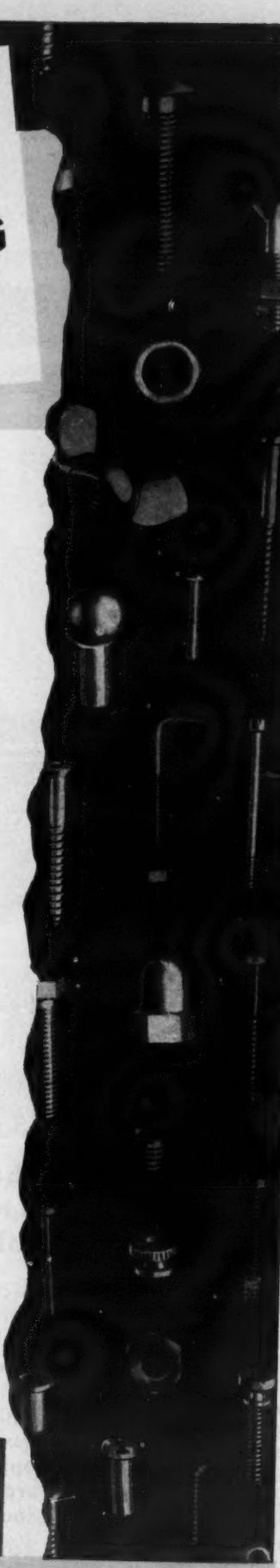
PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

Insure Your Product Against Rust

with

EVERLASTING FASTENINGS

by **HARPER**



YOU CAN insure your product against the ravages of rust and corrosion by using Everlasting Fastenings by Harper. The word, "Everlasting" refers to the alloys—brass, bronze, copper, Everdur, Monel and stainless steel. "Fastenings" refers to bolts, nuts, screws, washers, rivets and related "specials." For all practical purposes, they last forever.

Although the first cost of Everlasting Fastenings may be slightly more than the price of common steel or iron fastenings, the total cost is far less. Harper's Fastenings save hours and hours of time and labor required to replace rusted common steel bolts, they prevent failures of vital equipment and they keep production rolling regularly. They are not affected by ocean salt, tropic sweat, certain acids and alkalies and other tough conditions.

The H. M. Harper Company is the leading organization in America concentrating exclusively on fastenings made of the non-ferrous and stainless alloys.

4320 STOCK ITEMS

. . . of bolts, nuts, screws, washers, rivets and accessories in the non-ferrous and stainless alloys.

WRITE FOR CATALOG

. . . and reference book — 80 pages — 4 colors—193 illustrations—numerous tables and other data. Free when requested on a company letterhead.

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EVERLASTING FASTENINGS

ARMY E NAVY

BRASS ★ BRONZE ★ COPPER

EVERDUR ★ MONEL ★ STAINLESS

TECHNICAL LITERATURE

INSULATING MATERIALS—Standard specifications, methods of testing and supplementary material issued as of December 31, 1942, are compiled in a book "A.S.T.M. Standards On Electrical Materials." Copies of the publication can be obtained from American Society for Testing Materials, 260 South Broad St., Philadelphia, Pa., at $2.50 each.

PUMPS—Four different methods for renewing worn metal parts, (1) by machining and refinishing the worn section, (2) by building up and refinishing the section by welding. (3) by metal spraying, and (4) by electro deposition, including data and illustrations, are presented in "How to Recondition Worn Pump Shafts and Rods," obtainable from The International Nickel Co., Inc., 67 Wall St., New York, N. Y.

DRILLING RIGS—Booklet "Electric Drilling Rigs" has tables listing typical a.c. and d.c. equipment for drilling depths 3,500 to 20,000 ft., discusses electric drilling by d.c. variable voltage rigs and a.c. equipment, illustrates by diagrams the layout of equipment. The 57-page publication B-3038 may be secured from Dept. 7-N-20, Westinghouse Elec. and Mfg. Co., East Pittsburgh, Pa.

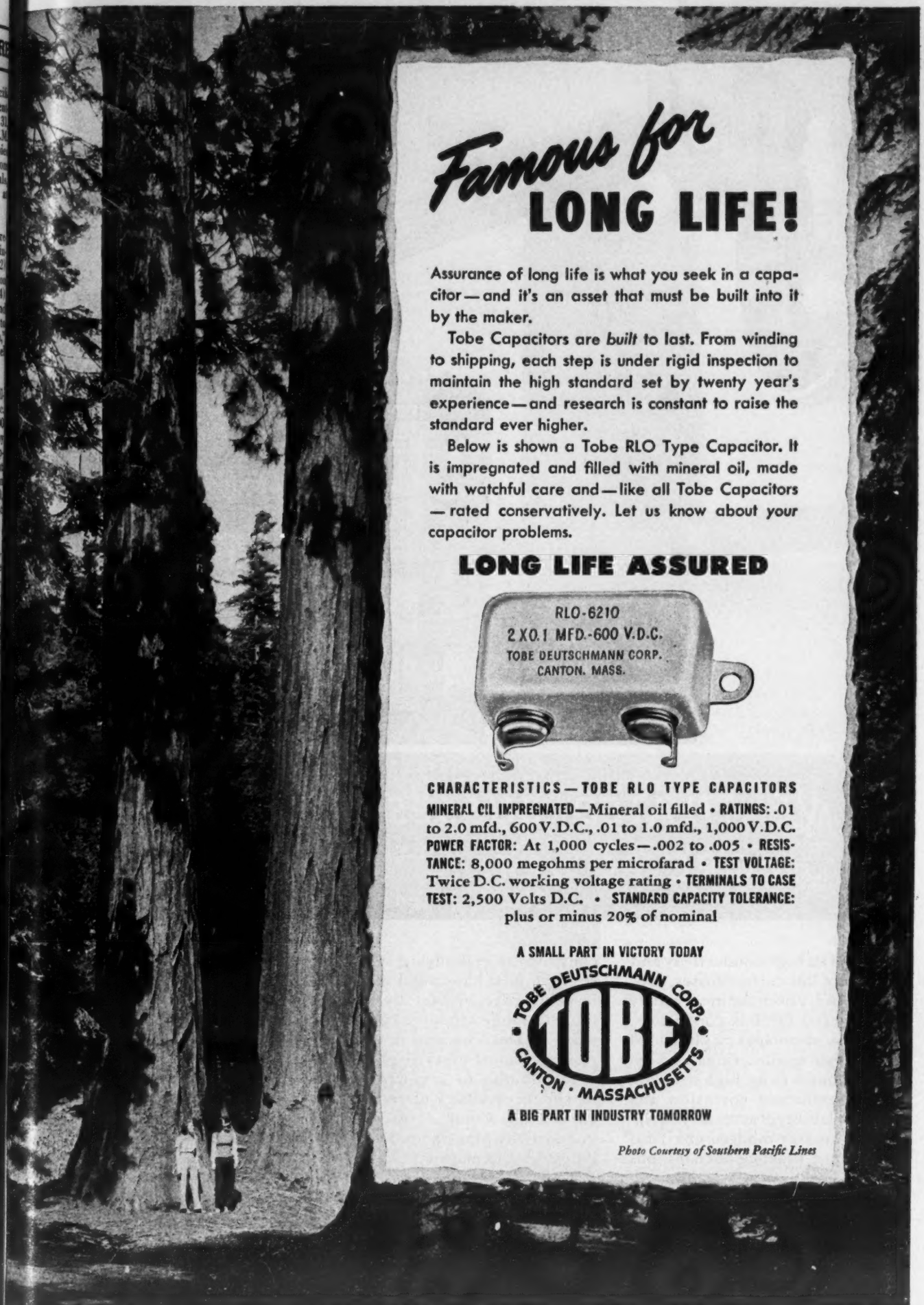
FURNACE TUBES—A report covers the investigation made to determine the cause and remedy for the wastage of tubes occurring in many wet bottom furnace installations. Copy of publication No. K-3, "Furnace Tube Corrosion," may be obtained from Edison Electric Institute, 420 Lexington Ave., New York, N. Y.; price 50 cents each to non-members in U.S.A.

MOTOR CONTROLS—Manual "Simplified Guide to the Selection and Application of Commonly Used Motor Controls" presents the fundamentals of control with numerous illustrations and explanatory diagrams, and explains how to choose between manual and magnetic, and when reduced-voltage starting is necessary. Publication GEA-4015 is available from General Electric Co., Schenectady, N. Y.

STEEL—Standard steel analysis chart outlines modifications and changes in analyses of AISI, SAE and new NE (National Emergency) steels up to Feb. 1, 1943, lists component elements of carbon and free cutting steels, manganese, nickel, nickel chromium, and molybdenum steels, in addition to chromium, chromium vanadium, silicon manganese and NE steels. Copies may be obtained by writing on your company's letterhead to the Sales Promotion and Advertising Dept., American Steel & Wire Co., Rockefeller Bldg., Cleveland, Ohio.

TIMERS—Tabulated data listing torque, time, revolutions, number of contacts, for selection of motor required for a specific timer, also a description of a synchronous motor driven multi-contact timer are contained in Bulletin C-497 available from The R. W. Cramer Co., Inc., Centerbrook, Conn.

STOKERS—Bulletin "Fundamentals of Stoker Operation and Maintenance" presents facts concerning operation, lubrication, inspection and maintenance of various types of stokers, also a technical paper entitled "Some Ways to Avoid High Stoker Maintenance." The 20-page publication can be obtained from Combustion Engineering Co., Inc., 200 Madison Ave., New York, N. Y.



Famous for LONG LIFE!

Assurance of long life is what you seek in a capacitor—and it's an asset that must be built into it by the maker.

Tobe Capacitors are *built* to last. From winding to shipping, each step is under rigid inspection to maintain the high standard set by twenty year's experience—and research is constant to raise the standard ever higher.

Below is shown a Tobe RLO Type Capacitor. It is impregnated and filled with mineral oil, made with watchful care and—like all Tobe Capacitors—rated conservatively. Let us know about *your* capacitor problems.

LONG LIFE ASSURED

CHARACTERISTICS—TOBE RLO TYPE CAPACITORS

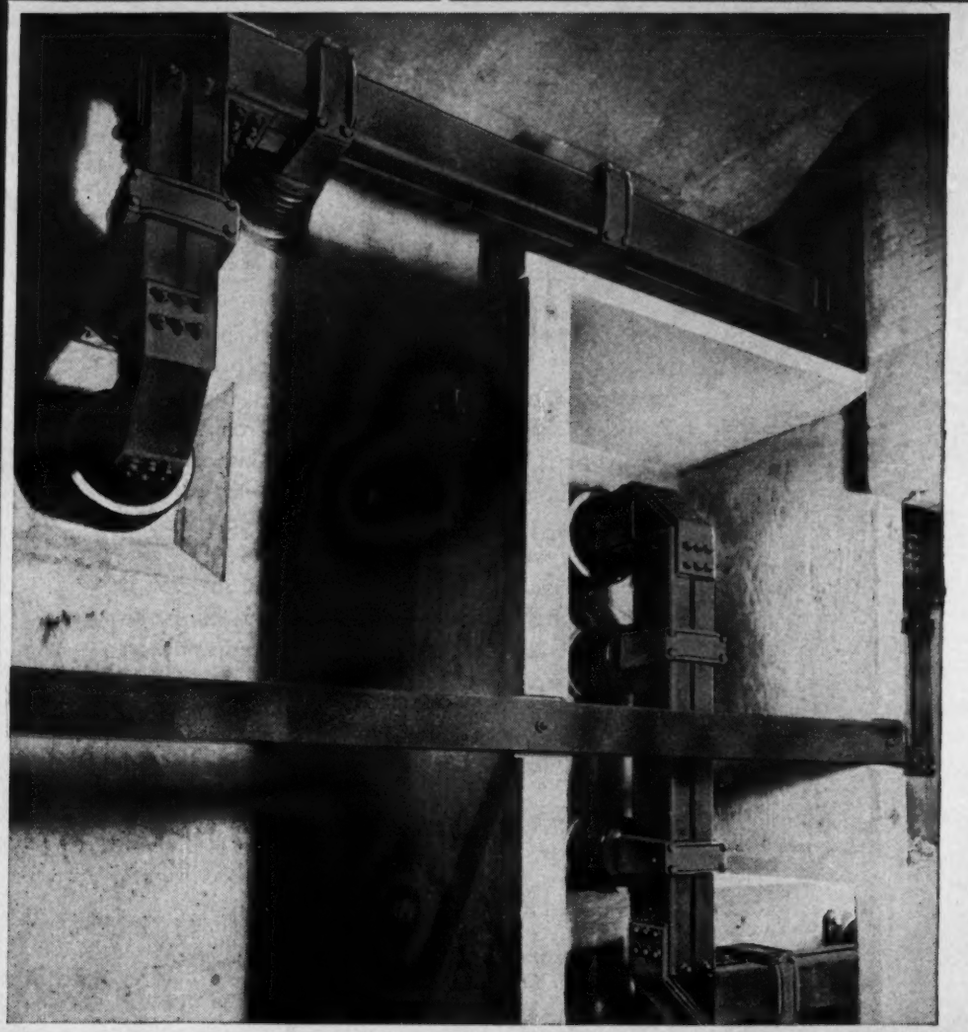
MINERAL OIL IMPREGNATED—Mineral oil filled • **RATINGS:** .01 to 2.0 mfd., 600 V.D.C., .01 to 1.0 mfd., 1,000 V.D.C. **POWER FACTOR:** At 1,000 cycles—.002 to .005 • **RESISTANCE:** 8,000 megohms per microfarad • **TEST VOLTAGE:** Twice D.C. working voltage rating • **TERMINALS TO CASE TEST:** 2,500 Volts D.C. • **STANDARD CAPACITY TOLERANCE:** plus or minus 20% of nominal

A SMALL PART IN VICTORY TODAY

TOBE DEUTSCHMANN CORP. TOBE CANTON • MASSACHUSETTS

A BIG PART IN INDUSTRY TOMORROW

Photo Courtesy of Southern Pacific Lines



BARS

TUBES

CHANNELS

ANGLES

CABLES

View of Anaconda Channel Bus Conductors in the new Venice, Illinois, station of the Union Electric Company of Missouri. This station, rated at 240,000 KW, is one of the largest in the world.

VENTILATED BUSSES HELP BRING MORE POWER TO WAR WORK

Because of its high conductivity and consequent low current losses, copper has always been the most widely used material for bus conductors.

To these advantages may be added such further qualifications as high thermal conductivity, high strength, high resistance to corrosion and ready availability of accessory equipment. Wherever modern electrical engineering practice dictates bus construction embodying structural strength, low ohmic and reactance losses or effective heat dissipation, the wide range of copper bus shapes made by The American Brass Company will meet every requirement.

In addition to a complete line of copper bus bars of rectangular shapes, this Company makes high conductivity pipe and tube, stranded cables and many special shapes.

Of particular interest to electrical engineers are the ventilated busses made from channels, angles, tubes and rectangular copper bars. Information, including the suggestions of our Technical Department on various bus conductors and assemblies, is available on request.

A new edition of our Bus Conductor Booklet, C-25, will be sent on request.

Anaconda Copper

ANACONDA

THE AMERICAN BRASS COMPANY—General Offices: Waterbury, Connecticut

Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ontario

NEWS ABOUT PEOPLE

E. D. Youmans to Direct Research for Okonite

E. D. Youmans has been elected vice-president and technical director of the Okonite Co., Passaic, N. J., and to the same position in Okonite's affiliate, the

Okonite-Callender Cable Co., Inc., of Paterson, N. J. Mr. Youmans, who was previously technical manager in charge of the Okonite Co.'s research laboratory at Passaic, will have the responsibility of co-ordinating the entire research program of the two organizations, including that of Okonite's Hazard Insulated Wire Works Division in Wilkes-Barre.

Starting with Okonite in 1913, Mr. Youmans obtained his technical education through evening classes at Brooklyn Polytechnic Institute while doing daytime work in Okonite's laboratory under the late James P. Millwood. He was appointed technical manager of Okonite in 1928. His work has been concerned with the development of insulated wires and cables in adapting synthetic rubber-like materials to these products, particularly for Navy shipboard cables.

He has taken active part in the preparation of standards and specifications in the National Electrical Manufacturers Association, American Society for Testing Materials and the American Standards Association, having served as chairman of numerous committees in these organizations.

Well known for his activities in the electrical and rubber industries, Mr. Youmans did considerable work on the wire and cable requirements of the 1940 edition of the National Electrical Code, and he is now co-operating with the War Production Board rubber director's office, the U. S. Navy and the U. S. Army in connection with the conservation of rubber.

•

Healy Assumes Broader Duties with Sylvania

F. J. Healy has been appointed vice-president in charge of operations of Sylvania Electric Products, Inc. He was formerly vice-president in charge of the lighting division. In his new position he will be responsible for all manufacturing operations in both the lighting and the radio tube divisions of the corporation.

Chester F. Horne, manager of operations at the fixture and appliance plants in Massachusetts, has been named general manager of the lighting division, replacing Mr. Healy. Mr. Horne will

F. J. Healy

be responsible for all manufacturing activities at the company's lamp, fixture, appliance and fluorescent powder plants in New England and Pennsylvania.

Both men have been connected with the company since its early days and both have been prominently identified with the company's development.

•

C. W. Higbee Promoted by U. S. Rubber Co.

C. W. Higbee has been made manager of the newly organized wire and cable department of United States Rubber Co., according to an announcement

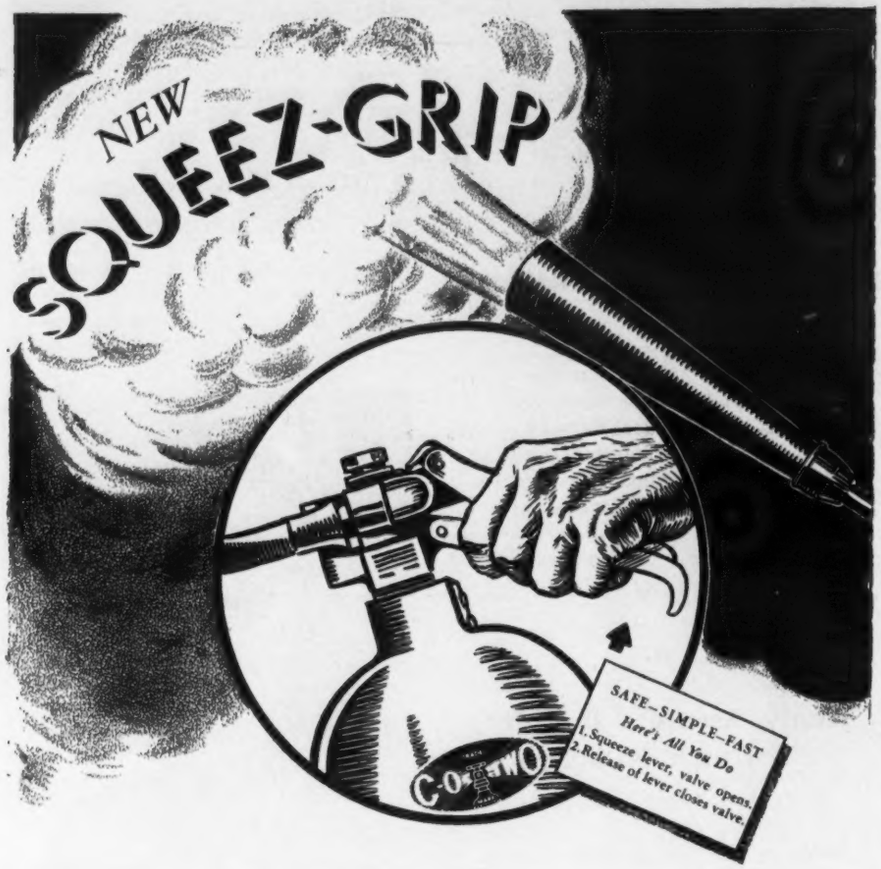
by W. H. Cobb, general manager of the company's mechanical goods division.

A native of New Jersey and a graduate of Rensselaer Polytechnic Institute. Mr. Higbee has been with the United States Rubber Co. since 1919, starting in the company's wire sales department at Bristol, R. I., where he later became factory superintendent. Subsequently he was assistant manager, and then manager of wire sales.

•

▶ MARVIN HATHCOAT, lawyer, Harrison, has been appointed a commissioner of the Arkansas Department of Public Utilities by Governor Adkins, succeeding FLOYD SHARP, who resigned to become state director of the War Manpower Commission. Mr. Hathcoat, a native of Harrison, resigned from the board of trustees of the University of Arkansas to accept the position of utility commissioner.

▶ JOHN FINLAW, assistant plant superintendent of the Schuylkill station of the Philadelphia Electric Co., has been appointed superintendent of the station. He entered the employ of the utility in 1912. Before becoming assistant superintendent in 1940, he held the positions of assistant station operator in 1912, substation operator in 1913, generating station operator in 1914, chief electrician 1916 and shift engineer in



Heretofore, time and gas were wasted when using a hand-wheel type valve for carbon dioxide extinguishers. Hence, for All-Out action against fire a fast and a gas saving type of release was required; an extinguisher that could be controlled while being carried . . . without the delaying time incident to setting a cylinder down to open or close the hand-wheel; a valve that would release the gas just as quickly as it could be shut off. The new C-O-TWO Squeez-Grip valve combines all these requirements.

Squeez-Grip is a Sensational New Release

It represents another of C-O-TWO's contributions to fire protection. With over a decade and a half of carbon dioxide fire extinguishing experience, C-O-TWO originated this all-inclusive Squeez-Grip valve. Carbon dioxide, the fastest non-damaging fire extinguishing agent, can now be released at the base of a fire as *fast as you can close your hand.* Fire is smothered in seconds, without damage to materials or equipment.

C-O-TWO is listed by the Underwriters' Laboratories; fully approved by Factory Mutuals and the Bureau of Marine Inspection and Navigation. C-O-TWO is a registered trade-mark. To be safe specify C-O-TWO.

C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK, NEW JERSEY
Sales and Service in the Principal Cities of United States and Canada

1917. In 1919 he was made assis load dispatcher and, in 1922, load patcher. He was made supervisor load dispatchers in 1928 and assis chief load dispatcher in 1931.

▶ LESTER PETTIBONE, plant engineer the Portland, Ind., municipal uti for 17 years, has been named super tendent of the Decatur, Ind., city li department, succeeding Martin Myl superintendent since 1913.

▶ MORTON ARENDT, assistant profes of electrical engineering at Colum University, New York, will retire June 30. Professor Arendt has been member of the engineering faculty Columbia since 1902. He holds fi patents for inventions including railw lighting and a.c. welding equipme He has been consultant to the Bure of Ships, U.S.N., since 1914.

▶ ALBERT A. CLARK has been appoint Santa Rosa district manager for P cific Gas & Electric Co., succeeding t late W. W. Shuhaw. A native Ca fornian, he entered Pacific Gas & El tric service in 1917 as a groundm becoming district agent at Newman 1921 and at Lodi in 1937.

▶ FRANK L. HALLOCK, who has be connected with Consolidated Edis Co. of New York, Inc., and its syste companies for 33 years, has retire Mr. Hallock has for many years be concerned with supervisory trainin and employee-customer relations. Se eral years ago he developed such trai ing programs for the Consolidated Ed son System, and at the time of his r tirement he was in charge of distri offices and customer service telepho divisions and of the employee trainin programs for the commercial relatio department, with the title of syste commercial manager. Mr. Hallo served as chairman of committees the commercial and accounting sectio of the American Gas and Nation Electric Light Associations.

▶ W. J. GEBHART, treasurer of Formi Insulation Co., Cincinnati, Ohio, h been elected vice-president of the co pany in charge of finances and accou ing. In the announcement publishe in the April 10 issue of ELECTRICA WORLD, page 16, covering the electi of five new vice-presidents, Mr. Geb hart's name was omitted in error. H has been associated with the compan for 20 years and has been treasure since 1936. Mr. Gebhart has also bee elected a member of the board of di rectors of the company.

▶ LLOYD ARNOLD has been appointe assistant to vice-president, finance, American Steel & Wire Co., subsidiar of U. S. Steel Corp. At the same tim RALPH RAYMOND has been appointe

This Lineman Knows—

THAT SERVICE MUST BE MAINTAINED—

Here's How *Nicopress* Will Help . . . .

• By saving precious time and decreasing labor. For any lineman with convenient Nicopress Tools and Nicopress sleeves will speedily make neat, uniform distribution line joints. • Because Nicopress splices will last as long as the line. They are so tight the conductors cannot pull out and they exceed the rated breaking strength of the conductors. • As all distribution line Nicopress sleeves are bevelled at both ends the wire pulls smoothly and easily over the cross-arms without snagging. • In making the Nicopress splice the wires go straight into the sleeve without distortion, bending or overlapping. This means conservation of material and permits splicing broken lines without changing sag. • When it is necessary to splice two wires of different size Nicopress Reducing Sleeves meet the need exactly and save time. • Nicopress sleeves are available in a wide size range for Copper, Copperweld and Galvanized Steel Wire, stranded or solid.

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THE NATIONAL TELEPHONE SUPPLY COMPANY

Manufacturer of Specialties for Power and Communication Lines

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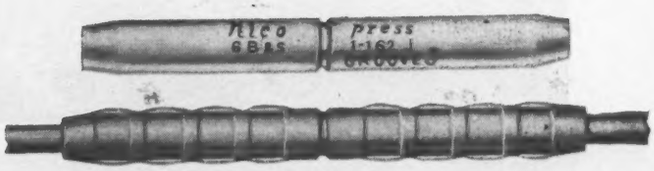
Canadian Manufacturer—N. SLATER COMPANY, LTD., HAMILTON, ONTARIO

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.



ON THE AVENUES of Portland, Oregon . . . everywhere throughout New York City . . . in city after city . . . and along mile after mile of highways and by-ways . . . Slater Lamps light the way to greater safety and savings. For every factor contributing to highly efficient and economical street lighting is embodied in each Slater Lamp. Advanced manufacturing methods assure an extremely high lumen output at low cost. Whether for street lighting, traffic lights, fire alarms, or one way arrows there is a Slater Lamp to meet your needs. Your investigation of Slater quality and cost will prove why they're a better buy.

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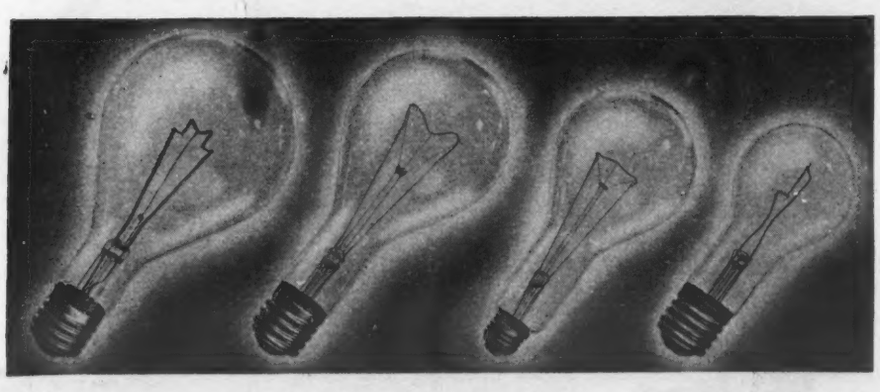
SLATER ELECTRIC & MFG. CO.
BROOKLYN, NEW YORK
MANUFACTURERS OF STREET LIGHTING LAMPS, ELECTRONIC TUBES AND EQUIPMENT



supervisor of organization planning, succeeding Mr. Arnold. Mr. Arnold has been connected with American Steel & Wire since 1900. Mr. Raymond was formerly connected with the U. S. Steel Corp. of Delaware in Pittsburgh, where, since May, 1942, he has been staff assistant in the organization planning division.

•

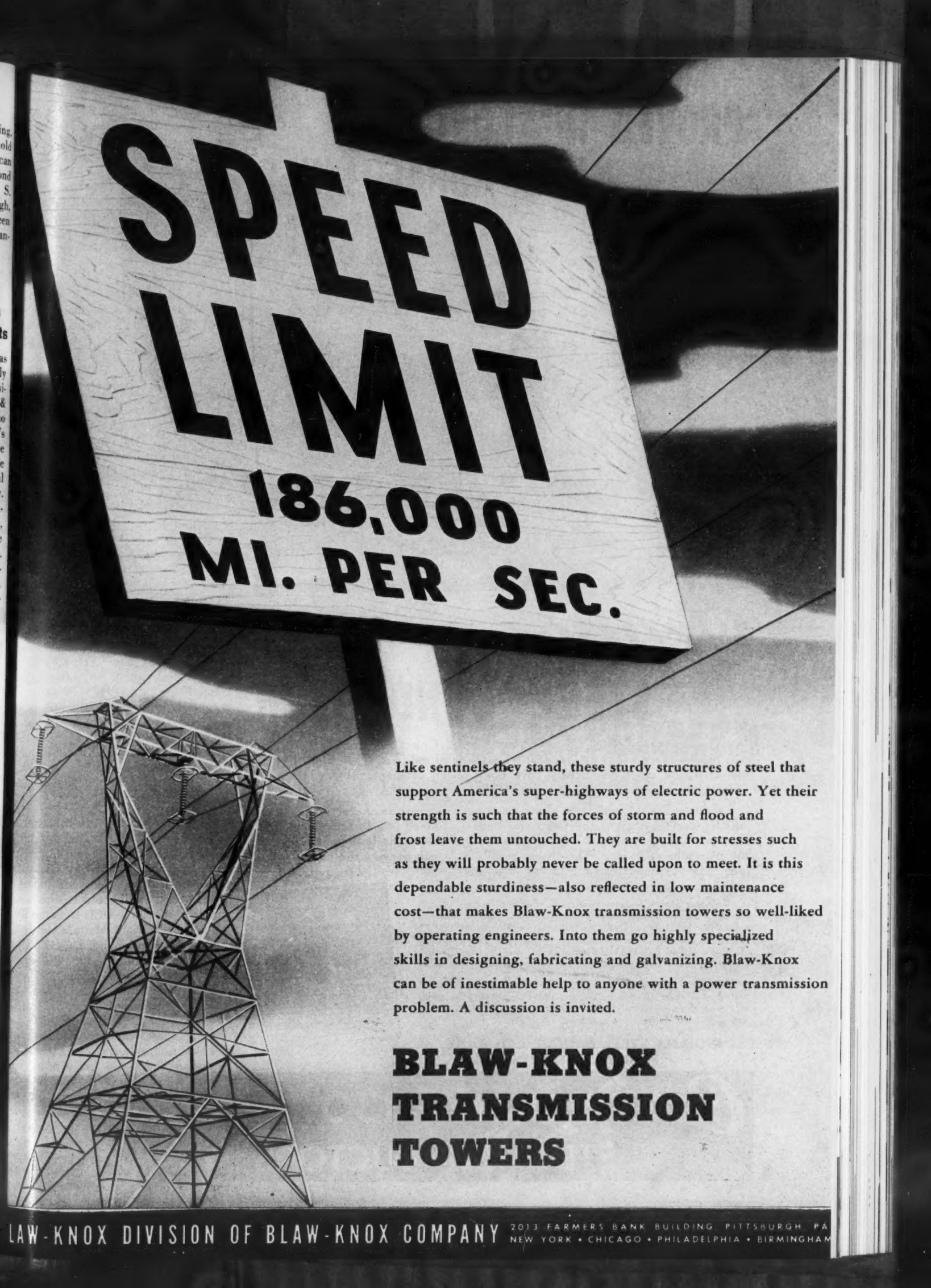
Westinghouse Announces New Assignments

Appointment of A. J. Bronold as assistant to vice-president was recently announced by B. W. Clark, vice-president of the Westinghouse Electric & Manufacturing Co. Mr. Bronold, who has been manager of the company's Los Angeles office since 1941, will make his headquarters in Pittsburgh. He will devote his attention to general marketing policies of the company. Succeeding Mr. Bronold as Los Angeles manager is Walter G. Willson, for the past 18 years Westinghouse manager at Phoenix, Ariz. Howard S. Warren, for the past 21 years an application engineer at Los Angeles, Calif., has been named Phoenix manager, succeeding Mr. Willson.

The new Fairmont, W. Va., works of the Westinghouse Lamp Division, Bloomfield, will be managed by John Rosevear, who has been connected with Westinghouse for 21 years. He formerly held the position of staff assistant in the industrial engineering and equipment department of the lamp division with headquarters in Bloomfield. As manager at Fairmont Mr. Rosevear will co-ordinate the manufacturing activities of the fluorescent plant, the new glass factory now being built and an electronic tube plant.

Recent Pacific Coast assignments included the appointment of Charles A. Butcher, formerly assistant to the national manager of the company's district manufacturing and repair department, to the managership of the department for the entire Pacific Coast district, and that of Frank H. Robb, formerly of Springfield, Mass., to the managership of the manufacturing and repair department for the Los Angeles area. Mr. Butcher succeeds R. E. Powers, resigned, and Mr. Robb succeeds Charles G. Yarbrough, who has retired after 47 years with the company.

J. R. Fulton has been appointed assistant to the manager of the industrial department. He was formerly manager of the company's marine section and in his new capacity has been assigned special duties, principally in the marine field. C. H. Weaver has been named manager of the marine



Like sentinels they stand, these sturdy structures of steel that support America's super-highways of electric power. Yet their strength is such that the forces of storm and flood and frost leave them untouched. They are built for stresses such as they will probably never be called upon to meet. It is this dependable sturdiness—also reflected in low maintenance cost—that makes Blaw-Knox transmission towers so well-liked by operating engineers. Into them go highly specialized skills in designing, fabricating and galvanizing. Blaw-Knox can be of inestimable help to anyone with a power transmission problem. A discussion is invited.

BLAW-KNOX TRANSMISSION TOWERS

LAW-KNOX DIVISION OF BLAW-KNOX COMPANY 2013 FARMERS BANK BUILDING PITTSBURGH PA
NEW YORK • CHICAGO • PHILADELPHIA • BIRMINGHAM

"PROVED IN" LONG AGO FOR RURAL LINES

IN SERVICE SINCE 1936

Crapo Steel Conductor in rural primary distribution line. Location: Texas. Average span length, 600 feet.

Crapo STEEL CONDUCTOR

The operating efficiency of *Crapo* Steel Conductors was established long before the present emergency. Thousands of miles of these high-tensile, low-resistance steel conductors have been giving efficient, reliable and economical service on rural lines since 1936.

Crapo Steel Conductors afford an unique combination of electrical characteristics and physical properties never before attained in a ferrous conductor. They provide relatively low 60-cycle resistance, low magnetic permeability and low 60-cycle reactance. Their high-tensile strength permits the use of long-span, low-cost construction; saves man-hours and material; reduces maintenance problems.

Crapo Steel Conductors can be handled and "pulled in" with the same facility as any other conductor. For rural extensions authorized by Utilities Order U-1-c, specify *Crapo* HTC-130 in No. 6 B.W.G. Stranded (3-wire) — the type recommended for this purpose. Ask the representatives of the Graybar Electric Company Inc., Distributors, or contact the nearest Graybar office!

WRITE FOR NEW ENGINEERING MANUAL containing complete technical information on *Crapo* Steel Conductors, including electrical characteristics and performance, sag and tension data and applicable construction practices! Address:

INDIANA STEEL & WIRE COMPANY
MUNCIE, - - INDIANA

Crapo HTC-130 STEEL CONDUCTORS

section of the industrial departm succeeding Mr. Fulton. Mr. We has been a member of the marine tion for the past three years.

Herbert W. McKeague, formerly sistant purchasing agent in the W inghouse Electric & Manufactur Co.'s radio division at Baltimore, been appointed purchasing agent in transformer division of the compan Sharon works.

•

▶ R. W. DAVIS, assistant manager, el trical department, Allis-Chalmers M ufacturing Co., has been appoint director of the electrical equipm branch, general industrial equipm division, War Production Board.

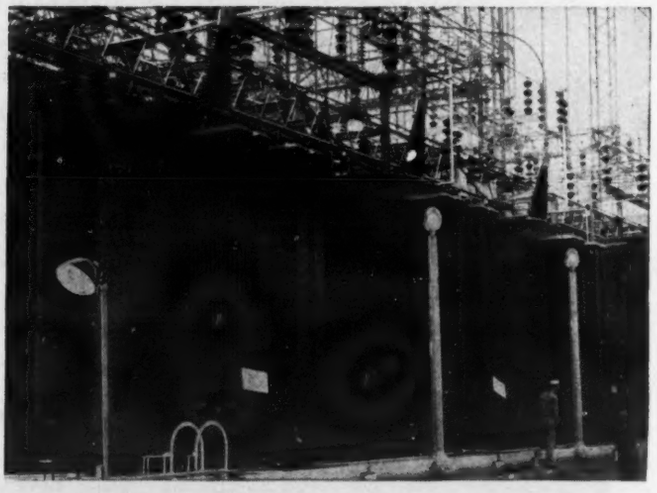
▶ E. J. CAMPBELL has joined the st of the Wolverine tube division of Ca met & Hecla, Detroit. Mr. Campb joined the Wolverine staff after spen ing nine years with the Detroit Edis Co. He will be in charge of the el trical department.

▶ ARTHUR B. GUISE, formerly engag in fire and safety engineering for t U. S. Rubber Co., has joined the Dug Engineering Corp., Marinette, Wis., vice-president in charge of develo ment. A graduate of the Massachuse Institute of Technology, Mr. Gui spent a number of years in develo ment work in the petroleum indust before joining the Factory Mutu Laboratories, where he was employe from 1935 until 1941. In the latt organization he was engaged in t special hazard phases of fire protecti engineering as well as being respo sible for the examination and test first aid fire-extinguishing equipmen He is a member of the National Fi Protection Association.

▶ FRANK A. HANSEN has been com pelled, because of ill health, to retire active head of the light control divisio Ninth Regional Office of Civilian D fense. He will be succeeded by FRED WELLHOUSE, well-known illuminatin engineer, on loan to OCD from the Wes inghouse Electric & Manufacturing C Frank Hansen founded and is th managing director of the Western I stitute of Light and Vision and is ac tive in the affairs of the Illuminatin Engineering Society on the Pacif Coast, having served as regional vic president last year. Mr. Wellhouse ha been continuously connected with West inghouse since his graduation fro Cornell University in 1909, with the ex ception of two years spent in the Army in World War I. He served the company in Boston and East Pittsburgh and i 1921 was sent to the Pacific Coast, a an application engineer in the power apparatus field, working out of the San

Here's a Job for
MOLONEY POWER TRANSFORMERS

HYDRO-ELECTRIC developments involve the investment of many millions of dollars. The Power Transformers required represent but a small portion of this investment. Yet, the delivery of electrical energy to points hundreds of miles from the generating source... to vital war industries, army training camps, airfields, schools, stores, and homes... depends upon the continuous performance of these transformers. Moloney Power Transformers combine all of the qualities necessary to provide dependable service under the most severe operating conditions... soundly designed, skillfully fabricated, fully processed, and carefully tested and inspected.



One of two 48,000 Kva banks of Moloney Transformers used at a hydro-electric development to step 13,200 volts generator voltage up to 161,000 volts for transmission.

MOLONEY ELECTRIC COMPANY • ST. LOUIS, U. S. A.

The new U.S.-made "Megger" Insulation Tester in molded plastic case. Ask for Bulletin 1735-W.

THE "MEGGER" TESTER IS ALWAYS READY

When the need arises for emergency insulation testing of electrical equipment—it calls for immediate and positive action. "Megger" Insulation Testers are *always* ready for use, day or night, even in the most remote, isolated, inaccessible locations. The self-contained hand-cranked generator is a source of power that is reliable and wholly independent of any battery or other outside source. The "Megger" Tester is a complete unit in itself.

For occasional use, for periodic tests and for emergency tests, your "Megger" Tester is *always ready.* If you do not have full information on how to use and operate "Megger" instruments, write for a free copy of the Pocket Manual of "Megger" Practice, No. 1420-W.

JAMES G. BIDDLE CO.
1211-13 ARCH STREET • PHILADELPHIA, PA.

"MEGGER"
TRADE MARK REGISTERED U.S. PAT. OFF.
Insulation Testers, Ground Testers and Ohmmeters

Francisco office. In 1931 he was a pointed to the special work of handli aviation and street lighting. He is pa chairman of the San Francisco secti of I.E.S. and is at present vice-preside of the national organization for t Pacific Coast region.

OBITUARY

▶ WILLIAM S. MEGONIGAL, assistant vice-president of the Philadelphia Ele tric Co. in charge of sales, died su denly at his home in Chester, Pa., March 24. Mr. Megonigal started in modest position with the Beacon Lig Co. in 1900 as a young man. He soo transferred to the sales departme He specialized in power engineeri and served as manager of the pow sales department for more than years prior to the assignment to h last position.

▶ ALLAN MACIVER, 65, for the past years superintendent of power an maintenance, Boston Terminal Co., die at a Boston hospital on April 9.

▶ RICHARD R. ANDERSON, deputy admi istrator of Public Utilities for Rhod Island, died recently at Providence. H had been connected with the regulator work of the state for 14 years, follow ing 35 years in the electric transport tion field.

▶ ROBERT H. ANTHONY, 65, New Eng land representative of the G & W Elec tric Specialty Co., Pennsylvania Trans former Co., Schweitzer & Conrad, Inc R. Thomas & Sons Co., Naugle Pole Tie Co., Memco Manufacturing Co Merit Glove Co., Electroline Co. an Minerallac Electric Co., Boston, die suddenly in his office in that city o May 1. He was a native of East Provi dence, R. I., and in earlier life wa active in the railroad supply field. Mr Anthony was highly regarded in th central station industry in the north east.

▶ GEORGE B. MESSICK, superintendent of the methods division, Philadelphia Electric Co., died suddenly in the Bryn Mawr Hospital on March 29, as the result of a heart attack. Mr. Messick started as an engineer of the Beacon station, Chester, in 1915, and distinguished himself by his expert knowledge of station operation. He was superintendent of Schuylkill station for some years prior to his appointment to his last position.

▶ ARTHUR G. SHELLEY, Washington representative of Combustion Engineering Co., died on April 28, in his fifty-third year, after an illness of several months. Mr. Shelley became associated with the Combustion Engineering Co. in 1933, following an

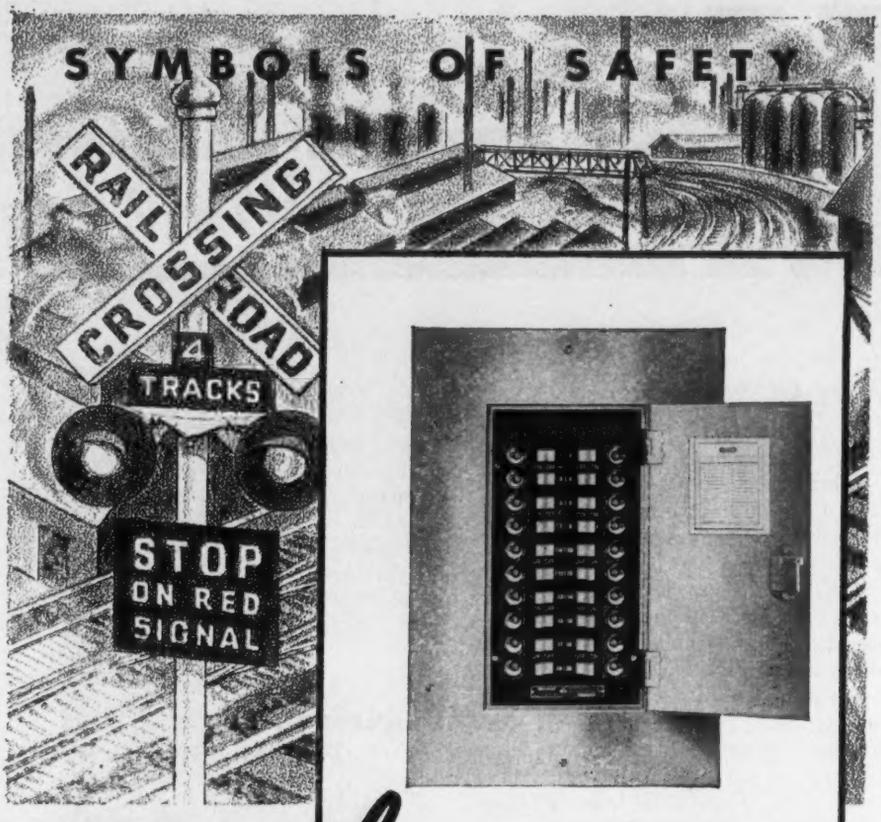
xperience of some 22 years in the ection, operation and sale of stokers r two of the large stoker manu- cturers. He was located for a con- derable period in the Cleveland dis- ict sales office and transferred to incinnati early in 1940. In November that year he went to Washington, . C., where most of his attention was evoted to negotiations for stationary quipment.

S. E. BARTLETT, who retired in 1940 s manager of the Albany, Wis., plant the Wisconsin Power & Light Co. fter 20 years' service with that utility, ied on April 28 in a Madison, Wis., ospital. Mr. Bartlett was 73 years ld.

JEAN R. ADRIAN, 42, a research engi- eer at General Electric's Lynn, Mass., ctories, died in that city on April 2. e was born aboard a British vessel in e Mediterranean and lived abroad for any years. He was educated at the niversity of Glasgow, Massachusetts nstitute of Technology and Harvard niversity.

R. E. JERAULD, assistant to the man- ger of General Electric Co.'s Los An- eles office, died in that city recently. r. Jerauld was born in Providence, . I., in 1880 and was graduated from hroop Polytechnic in 1902. He en- ered the service of General Electric o. at Schenectady in 1905 and in 1907 as transferred to the Salt Lake City ffice. In 1924 he was made resident gent at Phoenix, Ariz., and one year ater was promoted to manager of that ffice. He was appointed to the Los ngeles position in 1939.

WILLIAM O. RENKIN, industrial de- igner and engineer, who was associated or forty years with the steel industry, ied at Lancaster, Pa., on April 16, n his sixty-ninth year. Mr. Renkin was mong the first to apply pulverized fuel o steel furnaces and became an au- hority on the process. After several ears with plateglass enterprises, he ecame resident manager in charge of rganization and construction of the ata Iron & Steel Co. in Sakchi, Bengal, ndia, and later joined the A. M. yers Co. of Pittsburgh. As manager nd vice-president of the Quigley Fuel o., Mr. Renkin was in charge of de- igning and engineering and put into peration coal plants in 37 factories in he United States, Europe and South merica. Subsequently, while occupy- ng the position of manager of the in- ustrial furnace department of the ombustion Engineering Co., of New ork, he developed various methods for se in steel-heating furnaces. Later he as transferred to the management of he Coke Quenching Co., a subsidiary f International Combustion.



Federal PANELBOARD SAFETY FACTORS

INCREASE WAR PRODUCTION

Controlled, continuous lighting is essential for increased war production. That's why Federal panelboards are built with special safety features to insure perfect control and protection of lighting and small power circuits.

The rugged construction of Federal's low cost NTPR panelboards, for example, assures permanent alignment of working parts to reduce the danger of short circuiting. But there are many other safety features, such as—switch ahead of every fuse, floating contacts, large wiring gutters. This is true of *all* Federal Panelboards. Follow the leaders—for extra service and safety switch to Federal!

For Complete Panelboard Data

write for catalog 42. Contains all the essential facts on Federal NTPR and Mastertype panelboards.

FEDERAL ELECTRIC PRODUCTS COMPANY
54 PARIS STREET NEWARK, N. J.

PANELBOARDS • SWITCHBOARDS • SAFETY SWITCHES • CIRCUIT BREAKERS

MANUFACTURING-MARKETS

War Output Rises 170% Over 1942

Volume of war output by the Blaw-Knox Co. continues upward, having increased 10 percent in the first quarter of this year over the final 1942 period, and about 170 percent over the 1942 first quarter, William P. Witherow, president, told stockholders at the recent annual meeting.

Reviewing results of operations for the quarter ended March 31, Mr. Witherow reported that after providing for state and federal income and excess profits taxes—based on tax laws now in effect—and $200,000 for reserves for war and post-war adjustments, net profit for the first quarter was $409,764, or 31 cents per share, compared with $276,624, or 21 cents, for the corresponding 1942 period.

Commenting on the payment of dividends, Mr. Witherow said: "In order to facilitate the output of a rapidly growing volume of war production, the ratio of current assets to current liabilities has been reduced to a point below a 2-to-1 ratio, which, in accordance with the restriction in the company's bond indenture, prohibits dividend payments. Plans are being formulated so that consideration may be given to dividend action in the near future."

•

Duquesne Adopts Proctor "Swap" Plan

The Duquesne Light Co., Pittsburgh, is presenting the new plan originated by the Proctor Electric Co. to "swap" old appliances in customers' homes for war savings stamps, repair them and resell them to help overcome the shortage of new merchandise.

The plan is intended to go through electrical appliance dealers, who act as headquarters for the purchase of old appliances with war stamps, do the reconditioning, and resell them. The dealer benefits in a number of ways—especially through keeping his service shop operating at capacity, receiving scarce parts through dismantling of old appliances beyond repair, and participating in the profits accruing from resale of the appliance.

Duquesne's part consists of advertising the drive to bring out the old appliances from attics, shelves and cellars, through billboards, radio, bill stuffers, etc.

CHALK UP ANOTHER—Lieut. J. Douglas Gessford of the Navy presents the Army-Navy "E" pennant with star for exceptional production to L. D. Canfield, manager of the Westinghouse District Manufacturing and Repair Plant, Newark, N. J. The others are M. J. Gardinier, president of Local B-1035 of the I.B.E.W., and Capt. W. H. Gardner of the Army Air Forces

•

Cutler-Hammer Net Up in 1st Quarter

Cutler-Hammer, Inc., for three months ended March 31, reports a net profit of $537,653 after charges, $300,000 reserve for post-war adjustments and contingencies and a provision of $2,196,663 for federal income and excess profits taxes after deduction of post-war excess profits tax credit. This net is equal to 81 cents per share on the 659,998 shares of capital stock.

This compares with a net profit of $406,674, or 61 cents a share, for March quarter of 1942. An inventory and post-war adjustment reserve of $150,000 was provided in the 1942 March quarter.

•

Okonite Opens New Sales Office in New Orleans

Announcement has been made by the Okonite Co., Passaic, N. J., of the opening of a new sales office in 904 Pere Marquette Building, New Orleans, La. The new office is in charge of W. D. Stroud, sales engineer. The territory of the new sales office will include Louisiana, southern Mississippi and northwest Florida.

•

"E" Renewals Announced; More New Awards Made

Continued high output of Fiberglas materials urgently required by the armed forces has won for the Newark, Ohio, and Ashton, R. I., plants of Owens-Corning Fiberglas Corp. renewals of the Army-Navy "E" which was originally awarded last fall.

Ward Leonard Electric Co., Mount Vernon, N. Y., has also been given a renewal of the award. Chicago division of Philco Corp. has been awarded the "E," with a white star in recognition of its continued war production record.

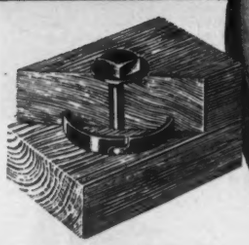
Additional plants to which the

FREEDOM IS NOT FREE—IT IS PRICELESS — *BUY WAR BONDS*

SELECTED FOR SERVICE

Topping the "spar tree" preparatory to forestry operations. Selective harvesting of fully matured trees in the surrounding forest will assure continued forest growth.

Lumber, in a thousand different forms, streams to the fighting fronts of the world. At home, wood replaces metal in thousands of heavy duty war structures—made possible by the TECO Connector System of Timber Engineering. This FREE Reference Book shows details of 45 typical timber designs for roof trusses, bridges, towers, tanks, hangars, and other structures for the war today and the peace tomorrow. Available to practicing engineers and architects. *Write* for it today—using your firm letterhead.



The *TECO* Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.

TIMBER ENGINEERING COMPANY

NATIONAL MANUFACTURERS OF ***TECO*** *TIMBER CONNECTORS AND TOOLS*

WASHINGTON, D. C. **PORTLAND, OREGON**

WOOD GOES TO WAR — An MGM Technicolor short by James A. Fitzpatrick. Ask your theater when you can see it.

For EVERY Industrial Lighting Need-

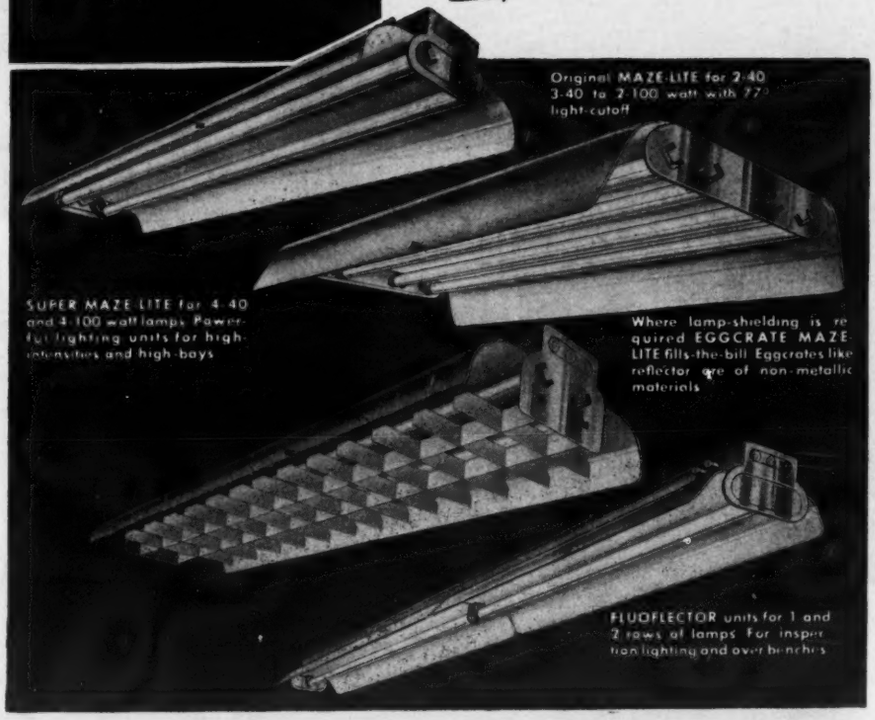
THERE'S AN EFFICIENT Guth Fluorescent FIXTURE!

THE GUTH Fluorescent Line is scientifically engineered to provide an ideal fixture to meet every industrial lighting need. There are many different GUTH Fixtures—each with a modern Non-Metallic Reflector finished in "300° White" Baked Enamel to actually deliver more light than Porcelain Enamel Steel Reflectors!

No matter where the installation goes—no matter what level of illumination must be maintained—you'll find the right lighting answer in—

Guth

The Complete Fluorescent Line


Original MAZE-LITE for 2-40 3-40 to 2-100 watt with 77° light-cutoff
SUPER MAZE-LITE for 4-40 and 4-100 watt lamps. Powerful lighting units for high-intensities and high-bays
Where lamp-shielding is required EGGCRATE MAZE-LITE fills-the-bill. Eggcrates like reflector are of non-metallic materials
FLUOFLECTOR units for 1 and 2 rows of lamps. For inspection lighting and over benches

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award has been given include the Lewis Foundry and Machine Division, Groveton, Pa., and the Martins Ferry division, Martins Ferry, Ohio, of the Blaw-Knox Co.

•

Manufacturers Issue Earnings Reports

Electrical manufacturing companies have recently issued corporate reports covering 1942 operations:

POLAROID CORP.—Including wholly owned subsidiary, International Polaroid Corp., total income from all sources, $4,119,120, compared with $1,032,425 in 1941. Net profit, after depreciation, amortization, write-offs, $281,114 State and Federal income and excess profits taxes and after transferring $50,000 to reserve for contingencies, was $97,831. Current assets on December 31, last, totaled $2,222,851 and current liabilities, $1,726,926.

CENTURY ELECTRIC—Net income $462,079 on net sales of more than $11,000,000, compared with $659,738 in 1941 on sales of about $7,900,000. Taxes are estimated at $1,093,000 for 1942, compared with $269,000 the year before.

HOWELL ELECTRIC MOTORS—Net income, $235,802, equal to $1.18 a share on 199,236 shares of common stock, compared with $189,560, or 95 cents a share in 1941.

ARROW-HART & HEGEMAN ELECTRIC—Including domestic subsidiaries, net income, $743,350, compared with $1,117,601 for 1941. Before Federal income and excess-profits taxes net profit was $2,475,050 last year, against $2,917,601 in 1941.

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"Bond Wagon" Campaign Launched by Hotpoint

Hotpoint's "Bombers Today—Bungalows Tomorrow"—campaign of 1942 is scheduled to play an encore in 1943 under the slogan— "Get Aboard the Bond Wagon." In nationally circulated magazines full-page ads are beginning to appear, illustrating kitchens that will be available after victory. Captions like "Some Day We'll Have the Electric Kitchen That Bonds Bought" give the planning homebuilder of tomorrow a real purpose for saving war bonds.

Last year's campaign won official recognition from the Treasury Department in the form of a citation "for distinguished services in behalf of the war savings program."

The 1943 "Bond Wagon" campaign will be presented this year to the entire building industry through co-operation with public utilities, recognizing the community of interests between the hundreds of thousands of families that will want to build homes after the war and the various organizations and agencies that will build and service those homes.

Field Reports on Business

Government buying continues at a steady pace and covers a wide range of electrical machinery and materials. Retail trade is brisk throughout the country. Planning for public welfare in the post-war period is taking concrete form, preliminary estimates of materials being under preparation.

NEW YORK

Reports from the heavy industries, generally, continue favorable. Retail trade showed up exceptionally well the past week, as warm weather increased the demand for seasonal merchandise, chiefly accessories and apparel.

Reports for the first quarter that have been issued by 260 industrial companies show a combined net income after taxes of approximately $254 million, which is 7 percent higher than the $237 million reported in the first quarter of 1942, but 24 percent lower than the $334 million in the first quarter of 1941. Numerous companies which a year ago were at a low point in the process of converting their plants from the production of peacetime goods to war materials are now showing gains in both volume and earnings, though in most cases lower margins of net profit per dollar of sales.

Civil engineering construction in continental U. S. for the week ended May 6 totaled $72,237,000, according to *Engineering News-Record*. This volume is 53 percent higher than in the preceding week, but is 83 percent below the record-breaking total of $434,955,000 reported for the corresponding 1942 week. The week's construction brought 1943 volume to $1,290,346,000, an average of $71,686,000 for each of the eighteen weeks of the year. On the weekly average basis 1943 volume is 59 percent below the $3,326,739,000 for the nineteen-week 1942 period.

PACIFIC COAST

Recent large new awards cover additions to present government facilities and even contracts for new locations. Expansions include an $11,972,524 award for naval hospital and convalescent quarters near Pleasanton, Calif.; a $1,540,700 addition to a California naval air station; $1,866,340 for miscellaneous marine installations in southern California; and smaller subcontracts, largely electrical, amounting to $2,000,000 in Bay area.

New locations include a Colorado air freight terminal; an air modification center, costing in excess of $3,000,000 also in Colorado; and a $1,000,000 award for barracks and housing in Idaho locations. All such construction will soon be reflected in current electrical business.

Recent orders cover wiring for dehydration and guayule rubber plants in many scattered locations; $27,067 for structural steel in 230 kv. Kennett switchyard of Shasta Dam system; fifty 20 kw. marine generators, costing $57,000; 150 motors of 3 to 10 hp., value $27,000; 3 carloads copper line and ground wire; a $140,000 shipment of welding sets and electrodes for a Bay region shipyard; and 550 fractional horsepower motors for pumping outfits.

A better-than-average rainfall in the early season has tapered off suddenly, and farmers predict that only another heavy rain will enable California to attain its $1,100,000,000 agricultural budget, and this opinion is reflected in considerable increase of orders for small pumping or pressure motors. Pacific Gas & Electric Co. is carrying on extensive educational work in northern California, site of most of dehydration plants for overseas shipment, urging individuals to build their own small dehydrators by utilizing a convection heater or bank of 100-watt lamps.

CHICAGO

Including new contracts valued at $8,941,787 undertaken during April the Chicago area in the first four months of 1943 has increased its factory facilities by industrial developments worth $58,219,937. Industrial developments recorded during the month of April involved additions to local precision machine shops and new major expansions of war plants erected during the past two years.

In the period of April 23 to May 6, one hundred forty-eight Chicago area concerns received 250 war orders. These federal contracts totaled more than $16,862,000.

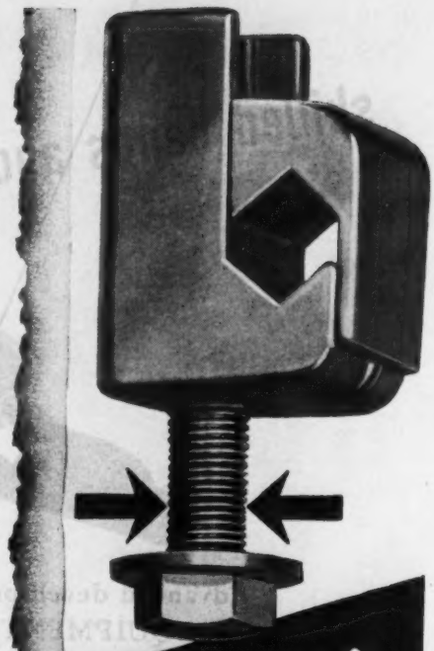
Department stores sales in Chicago for the week ended May 1 were 5 percent below the corresponding week a year ago, but a gain was shown for the four weeks ending May 1 over the same period last year, the Federal Reserve Board reported.

Wide divergence in trends of Chicago business for March is evident in an analysis just released by the Chicago Association of Commerce. Compared with March, 1942, practically all indices reflected the effect of the war economy. Payrolls showed gains; actual pay for factory workers was up 30.5 percent over last year; personnel affected increased 10.8 percent. Local public utilities had a good month. Consumption of electric power was up 13.5 percent, against an increase of 7 percent a month earlier.

NEW ENGLAND

Boston City Hospital bids for installing A.C. standby service were received last week for a project which will cost in the neighborhood of $30,000. Boston Edison is installing about 20,000 Dennison dimout shields on street lamps in its territory, the design allowing radial wave reflectors to remain in place. Radio transmission apparatus and supplies for wiring in signal stations and coast guard mounts are still active leaders in the electrical market. New construction projects are limited to pressing Army needs. Raytheon Production Corp., Newton, Mass., has been authorized an allotment of $90,000 for adding to its plant. Six new buildings costing $455,000 will be erected by the Springfield (Mass.) Bronze & Aluminum Co., including a pattern shop and a garage. A $50,000 bank building contract was been awarded to F. Grande & Son, Medford, Mass., and several small contracts averaging $1,000 up to $5,000 have been awarded for improvements in government buildings in New England.

Factory expansion and changes in the Boston area are accounting for moderate sales of small motors and control equipment. An order for friction tape amounting to about $25,000 was placed by the Navy with a Massachusetts manufacturer recently; tenders were submitted by Massachusetts manufacturers for furnishing a large group of radio operators' cabinets, and among other current quotations are listed resistors, capacitors, magnet wire and electric cable, and small switches. New England retail trade is unusually brisk.



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The SMALL BOLT in the Fargo Connector cuts friction to a minimum, tightens the tap in smooth, easy turns. Clean, precisely machined threads in both the bolt and connector body further assure easy, friction-free turning and high pressure contact at low torque. And remember, you can count on a Fargo to "grip like a vise" even after years of repeat use on the line.

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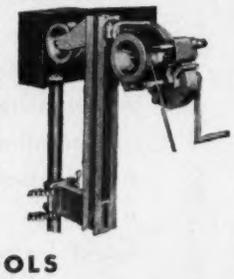
No. 765 CABLE PULLER

This handy Greenlee Cable Puller clamps right on to the conduit through which cable is pulled, is easily carried to the job, can be set up in a jiffy, and is easy for one man to operate with one or two cranks and will save many hours of work when pulling in cables.



COMPLETE LINE OF BENDERS

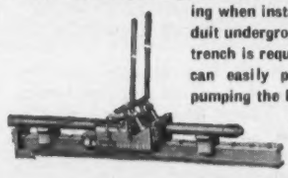
For any bending job there's a Greenlee Bender. Small hand benders and powerful hydraulic benders for conduit, pipe and tubing from ¼ to 4½-inch size. They are easily operated by one man, save the cost of many manufactured bends, and are easily carried to the job.

KNOCKOUT TOOLS

Enlarge holes without long tedious drilling, reaming and filing with Greenlee Knockout Punches and Cutters. This handy tool is inserted in a knockout or a small drilled hole and a smooth accurate hole can be quickly cut by turning the drive nut with an ordinary wrench.

HYDRAULIC PIPE PUSHERS

Greenlee Pushers eliminate digging long trenches, tearing up lawns, breaking through concrete, backfilling, and tamping when installing pipe or conduit underground. Only a short trench is required and one man can easily push the pipe by pumping the handles. Pays for itself on the first or second job.



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Find out how these and other Greenlee Tools for the Electrician, Carpenter, and Plumber can help speed up your jobs . . . write for Catalog 33E.

G. E. Employees Earn $382,039,000 in 1942

Total earnings of General Electric employees amounted to $382,039,000 for 1942, compared with $257,400,000 a year earlier, an increase of 48 percent, President Gerard Swope has announced. The average number employed during 1942 was 139,939, compared with 109,689 during 1941. Average annual earnings per employee amounted to $2,730 in 1942 compared with $2,346 in 1941, and were the highest in the history of the company.

There were 160,299 employees on the company's payroll on December 31, 1942, including 48,719 women. This represented an increase during the past year of 37,459 in the total number of employees and 19,322 in the number of women employees. General Electric employees in military service at the end of the year numbered 21,280.

Between May 1, 1941, and December 31, 1942, employees paid for United States war bonds with a maturity value of $41,200,000 and as of December 31, 1942, 91.7 percent of all employees had authorized payroll deductions for the purchase, at an annual rate, of U. S. War Bonds with a maturity value of $52,200,000.

•

A.S.A. Issues New Radio Parts Standard

First aid for home radio receivers off the air because of defective transformers or chokes is promised in the new war standard for replacement of these critical parts, just issued by the American Standards Association. The new standard, "Power and Audio Transformers and reactors, Home Receiver Replacement Type," covers the performance and quality requirements for a simplified list of 14 such units which, it is estimated, will be sufficient to service about 90 percent of the radio sets now in operation.

This is the fourth series of standards for radio replacement parts being developed by the A.S.A. with the cooperation of the radio industry, OPA and WPB.

•

Names District Manager

Tri-State Supply Corp. has appointed Bert Deleray San Francisco manager. For several years Mr. Deleray has been manager of the Los Angeles office of Westinghouse Lamp Co. In announcing Mr. Deleray's appointment, A. H. Howard, secretary and general manager of the company, stated that an office of the company would be opened soon in Seattle.

BOOKS RECEIVED

Report of Oil Engine Power Cost for 1941—Published by the American Society of Mechanical Engineers, 29 West 39th Street, New York. 44 pages. Price $1.25.

Tabulated operating and cost data in detail for 151 slow-speed stationary diesel plants with comparative data on many covering twelve years.

Industrial Instruments for Measurement and Control. By Thomas J. Rhodes. Published by McGraw-Hill Book Co., New York. 573 pages, illustrated. Price $6.

While a unit in the Chemical Engineering Series, this book by a practicing industrial engineer is equally significant to power plant staffs and industrial electrical engineers because it gives explanations of the design objectives and functional performance of indicating and control equipments which would otherwise require the study of dozens of manufacturers bulletins. Even then, few such bulletins reveal the principles and details as lucidly for such items as gauges, thermometers and pyrometers, flow meters, liquid-level and telemetering. The latter third of the pages is devoted to the theory and functional principles of auotmatic control of combustion and other industrial processes; flow and pressure, regulators, servo-operated mechanisms, pilot valves, throttles, proportioning, floating, pH meters, etc., are identified and discussed.

A Guide to Cathode Ray Patterns. By Merwin Bly; John Wiley & Sons, Inc., New York, 39 pages, illustrated. Price $1.50.

Facility in interpreting deflection patterns is an art, for many it is something they yearn. This spiral-bound 8 x 11 note book is devoted wholly to 175 sketches (with concise captions) that tell what typical patterns signify as to phase departures, frequency effects, Lissajous, modulations, sine distortions, resonance and tube characteristics. The compiler and classifier is associate engineer in the Navy. It is an "at-the-elbow" reference for the occasional oscillographer.

College Physics. By Henry A. Perkins. Prentice-Hall, Inc., N. Y. 802 pages, illustrated. Price $6.

Revision of the 1938 edition of this text book has retained all the unusually effective self-help attributed while modernizing the treatment by incorporating the electrophysics of the fluorescent lamp, electron microscope, the mestron and nuclear fission, as well as simplifying the formulation for Newton's second law and the troublesome gravitational measure of force.

Dictionary of Science and Technology (English, French, German, Spanish). By Maxim Newmark. Philosophical Library, New York. 386 pages. Price $6.

Translator and teacher of foreign languages in a polytechnical institution selects 10,000 American scientific and technical terms and gives their French, German and Spanish equivalents along with their gender. To avoid duplication, these are referred (by item number) to the English entry. Consequently there are some 50,000 terms in the book and sampling shows that approximately 5,000 are exclusively electrical terms. Omission of "amortisseur winding" is excusable, but of "bridge" and "reactive power" is less so, without, however, detracting materially from the handy usefulness of this four-language dictionary for electrical folk.

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Don't abuse them!

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Most tools do not wear out. They are broken, damaged or lost long before they serve their full life. Conserving tools will add months, even years to their usefulness.

As a contribution to this tool-conservation program, we have prepared a booklet packed with suggestions on the care and safe use of tools. A copy of this booklet will be sent to anyone interested.

Handle tools carefully—treat them well. Quality tools are built to stand hard use—not abuse. Remember that a broken tool is a "break" for Hitler.

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Foreign Distributors:

International Standard Electric Corp., New York

Write for this free booklet on the care and safe use of tools.

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EASY TO INSTALL LOW IN COST

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Sales Opportunities

OHIO—Ohio Public Service Co., Cleveland, has authorized immediate construction of new transmission line from steam-electric generating station on Ohio River, in course of erection for number of months past, to connection with main high-tension system. Work will include switching station and other operating facilities.

PENNSYLVANIA—Murray Corp. of America, Inc., 7700 Russell Ave., Detroit, Mich., manufacturer of steel automobile bodies, steel stampings, etc., plans new plant for production for government, comprising several one-story buildings, with machinery and electrical equipment for large capacity. A power substation is planned. Entire project will cost about $4,000,000, with financing by Defense Plant Corp.

ILLINOIS—War Department, Washington, D. C., has approved plans for new army general hospital, comprising large group of one-story buildings for wards, clinics, barracks, mess hall, administration building, shops and miscellaneous structures. A power substation is planned, with electrical distribution system and complete service facilities. Also a power house for central-heating system, mechanical laundry and other operating units. Construction contract is scheduled to be awarded soon. Entire project will cost about $4,000,000, and will be supervised by U. S. District Engineer Office, 222 North Bank Dr., Chicago.

WISCONSIN—State Department of Public Welfare, State Capitol Building, Madison, has plans under way for new power plant, 80x120 ft., and 60 ft. high, at State Prison. Estimates of cost will be made and appropriation arranged in near future. Also, application will be made for a priority rating. Roger C. Kirchhoff, address noted, is state architect.

GEORGIA—Firestone Tire & Rubber Co., Akron, Ohio, plans plant for production for government, including main one and multi-story building and several auxiliary structures, with machinery and electrical equipment for large capacity. Cost estimated about $600,000, with financing by Defense Plant Corp. Work is scheduled to begin soon.

NORTH DAKOTA—Civil Aeronautics Administration, Washington, D. C., and district office at St. Paul, Minn., will begin work soon on new airport project comprising hangars, shops and miscellaneous buildings, with electrical equipment. Also lighting system, with distribution lines and control station. Entire project will cost about $950,000, and appropriation in that amount has been authorized.

FLORIDA—Bureau of Yards and Docks, Navy Department, Washington, D. C., has approved plans for naval air station, comprising hangars, shops, warehouses and other buildings, with mechanical and electrical equipment. Also barracks and other housing structures. A power substation is planned with electrical distribution lines and service facilities. Entire project will cost about $15,000,000. Contract for building erection has been let to Byrnes Construction Co., care of J. W. Shelton, purchasing agent, San Carlos Hotel, Pensacola.

NEW YORK—E. I. duPont deNemours & Co., duPont Building, Wilmington, Del., has contracted with government for construction and operation of new plants for production of chemical products for war service in New York and Virginia, each to comprise several processing and production buildings, with auxiliary structures and machinery and electrical equipment installation for large capacity. Entire project will cost about $4,400,000, with financing by Defense Plant Corp. Proposed to carry out work at early date.

OHIO—War Department, Washington, D. C., has completed plans for new army general hospital, consisting of a group of over 100 buildings, one and two-story, including shops, warehouses, clinical and storage units, mess halls, guard house, administration building, barracks and other structures. A power plant will be built for light and power service, with complete electrical distribution system and service facilities. Also mechanical-laundry plant, central-heating station and other operating units. Bids are being asked for construction of various buildings at different times. Entire project will cost about $6,000,000. Wilbur Watson & Associates, 4614 Prospect Ave., Cleveland, are architects. U. S. District Engineer Office, 925 New Federal Building, Pittsburgh, Pa., will supervise project.

WEST VIRGINIA — Explosive Products Corp., Washington Building, Washington, D. C., plans power plant in connection with housing development and hospital. Project will comprise group of over 15 buildings, and is reported to cost in excess of $1,500,000. It is understood that financing will be provided by the government. Work is scheduled to begin soon. Workmen's Housing Corp., 2000 West 25th St., Cleveland, Ohio, is architect and engineer.

ILLINOIS—Wyman-Gordon Co., Worcester, Mass., manufacturer of steel forgings, etc., plans expansion in plant for production for government, including several new buildings, with installation of machinery and electrical equipment for large increased output. Cost about $1,400,000, with financing by Defense Plant Corp.

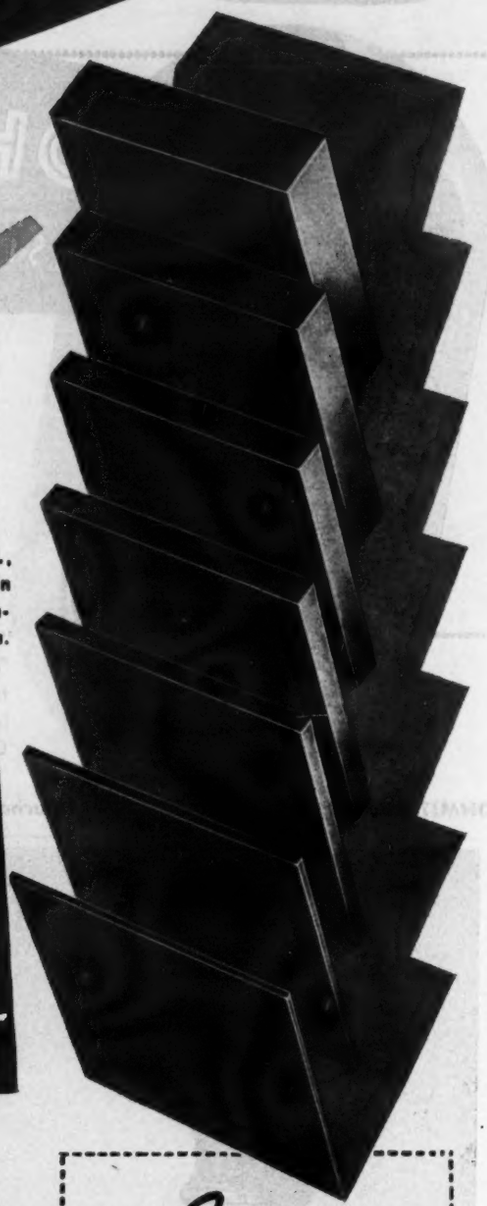
FLORIDA—Bureau of Yards and Docks, Navy Department, Washington, D. C., has approved plans for additional buildings at Naval Air Station, including hangars, shops, warehouses and other buildings, with electrical equipment installation. Also extensions in distribution lines for increased services. Entire project will cost about $1,434,900. Contracts are being awarded for building erection, and work will be placed under way soon.

OHIO—Dayton Power & Light Co., Dayton, plans development of new source of water supply, to include pumping station with motor-driven pumping units, controls and other facilities. Entire project is reported to cost close to $100,000, with pipe lines, etc. H. P. Jones & Co., Toledo Trust Building, Toledo, are engineers.

ILLINOIS—Clearing Machine Corp., 6499 West 65th St., Chicago, manufacturer of hydraulic and pneumatic presses, etc., plans expansion in plant for production for government, including new building and installation of machinery and electrical equipment. Cost about $215,000, with financing by Defense Plant Corp.

TEXAS—City Council, Dallas, is considering purchase of site for new municipal airport, to be carried out in conjunction with Civil Aeronautics Administration, Washington, D. C., including hangars, shops and other buildings, with electrical equipment. Cost estimated about $5,000,000.

CHECK THESE POINTS
IN SELECTING YOUR ELECTRICAL
INSULATING MATERIAL



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NON - CRITICAL, therefore available in any quantity for immediate application.

PROMPT SHIPMENT in all sizes and thicknesses in which now produced.

LIGNOLITE
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PLASTIC
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LIGNOLITE has all of the vital qualities that make it ideal for standardization and for wide application. Investigate this material now for your immediate needs or its possibilities as regards your future planning.

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LIGNOLITE is available in black color with either a satin or molded sand blast finish. The following sizes are now produced—46-inch x 46-inch and 28-inch x 72-inch sheets in thicknesses from 1/64th to 5/8-inch inclusive and 40-inch x 40-inch sheets in thicknesses of 5/8-inch to 2-inch inclusive. Also available: fabricated parts to your specifications.

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Recent Legislation

NEW YORK—Governor Dewey has approved the Warner bill as chapter 709, laws of 1943, providing for interstate cooperation for use, conservation, protection and equitable diversion of water resources in Delaware River basin to meet present and prospective needs for domestic and municipal water supply; water power and control division shall act as agent of state.

OHIO—Senate utilities committee has recommended passage of a measure to revise the method of computing the value of utility properties for rate-making purposes. The measure, which has the support of Gov. John W. Bricker (ELECTRICAL WORLD, April 17, page 143), provides for the actual or historical cost method of determining value of public utilities property for rate-making purposes, as contrasted with the present reproduction cost new less depreciation method. George C. McConnaughey, chairman of the Ohio Public Utilities Commission, estimated that use of the proposed new yardsticks would save taxpayers at least $400,000 on each major rate case, and would cut the time required in half. The proposed law would permit the commission, once it has established the investment of a utility company, to use that figure in future rate cases after making changes to cover improvements, retirements, and depreciation. Meanwhile, the Ohio House has approved a measure authorizing municipalities operating utilities to set up a board of managers to supervise such agencies. This measure enables the city of Bowling Green, Ohio, for example, to legalize operation of its light and water plants, recently purchased from the Ohio Northern Light & Power Co. and operated under board management, but without state sanction.

OKLAHOMA—Governor Kerr has signed a bill providing for a 2 percent gross receipts tax on rural electric co-operatives in lieu of other taxes.

•

Recent Rate News

DEER RIVER POWER CO.'s reduced rate schedule for electric service in the village of Copenhagen, Lewis County, and in adjoining territory in the town of Denmark, Jefferson County, shall remain in effect until otherwise ordered, the New York Public Service Commission has ruled. The proceeding was instituted by the commission on complaint of customers as to the rates charged by the company. After several hearings, the commission, in January, 1941, prescribed temporary rates involving a sharp reduction to remain in effect pending conclusion of the investigation. In a memorandum on the subject, Commissioner Neal Brewster, who made the recommendation, concluded that the temporary rates ordered in 1941 were fair and reasonable and should remain in effect as the maximum rates to be charged until further orders of the commission. This in effect makes the temporary rates permanent. Prior to the investigation the company charged residential users 9 cents per kilowatt-hour for the first 100 kw.-hr., 8 cents per kilowatt-hour for the next hundred kw.-hr., 7 cents per kilowatt-hour for the next 300 kw.-hr., 6 cents per kilowatt-hour for the next 500 kw.-hr., 4 cents per kilowatt-hour for the next 500 kw.-hr., 3 cents per kilowatt-hour for the next 500 kw.-hr., 2 cents per kilowatt-hour for the next 2,000 kw.-hr. and 1.5 cents per kilowatt-hour for use over 4,500 kw.-hr. The temporary rate

ordered by the commission established a monthly minimum charge of $1.25 per kilowatt-hour, but stipulated that 15 kw.-hr. of electricity be allowed in the minimum charge. The next 45 kw.-hr. under the temporary rate was fixed at 6 cents per kilowatt-hour and 5 cents per kilowatt-hour for the next 140 kw.-hr., and for all use over 200 kw.-hr. at 2 cents per kilowatt-hour. Reductions were also ordered for non-residential service.

CITY OF TWO RIVERS, WIS., has been ordered by the state Public Service Commission to apply its urban rates plus 25 percent to service rendered rural customers. Reduction in the city's revenue from rural users will be decreased about 25 percent with a loss of from $500 to $1,000 annually.

LETTERS TO THE EDITOR

Guide for Electric Meter Application

To the Editor of ELECTRICAL WORLD:

In the January 9, 1943, issue you published a "Guide for Electric Meter Application — Single-Phase Domestic Loads." An item was inadvertently omitted from the chart.

In 1937 the Westinghouse company made an improvement (little publicized) in the overload characteristics of its type CA watt-hour meter, beginning with Serial No. 15,000,000. Accordingly, the following data should be made available so that those persons who are using the chart can make the addition:

Meter type, W. E. & M. Co. type CA, serial No. 15,000,000 and over; year first manufactured, 1937; "maximum economic limit of 140 kw.-hr. per month can be measured economically by 5-amp. rated, 115-volt, single-phase meter; 375 kw.-hr. per month, 15-amp. meter; 1,300 kw.-hr. per month, 50-amp. meter.

R. A. CALDWELL,
Meter and Transformer Engineer,
Interstate Power Co., Dubuque, Iowa.

•

Consequences From Page Number Omissions

To the Editor of ELECTRICAL WORLD:

Damn it, I am not going to read your editorials any more! You tell me that it is on page 37, but there is no page marked 37. You want me to hunt for page 36 and guess that the next must be 37. But there is no page marked 36! So, I suppose you want me to hunt up page 35 and count from that. But there is no page 35, either, so I suppose I must hunt for page 34 and men-

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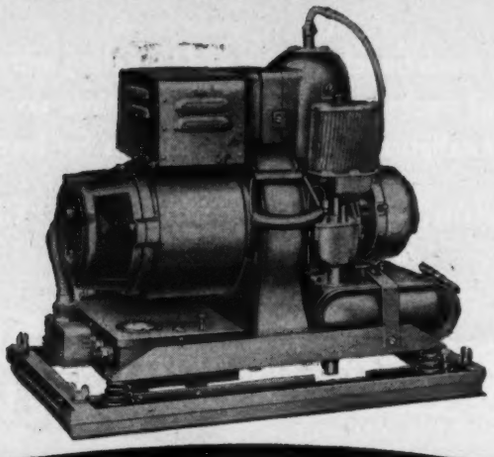

Portable Generators

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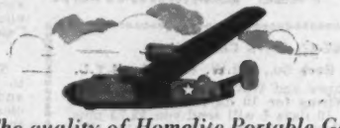
But the big job now is to meet the greatest emergency of all time . . . *the war.* Therefore, all new Homelite Generators must go to the Armed Forces . . . to help our Air Force, Tank and Signal Corps do their jobs better and faster.

To meet the requirements of our fighting forces, many improvements have been added to Homelite Portable Generators. Our new models are more powerful, more rugged, and more able to operate under all conditions than ever before. And because of this they'll be far more valuable to you who will get them after the war.



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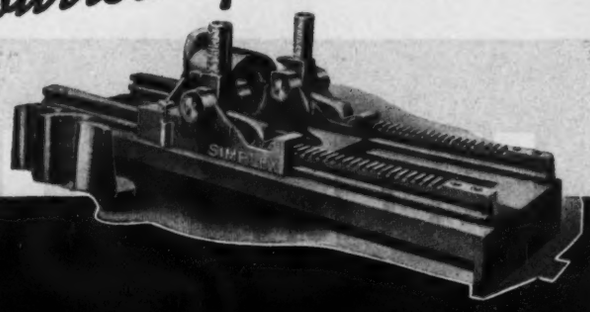

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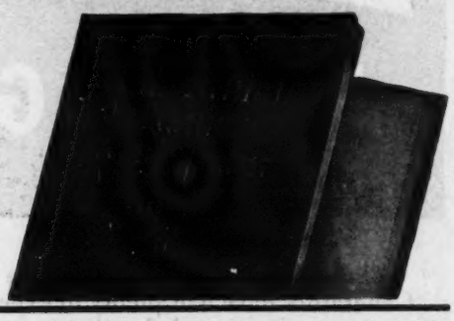

This book offers the practical worker a thorough training in electrical wiring for every industrial application. It not only gives standard, economical and efficient methods for doing every type of wiring, but also gives the groundwork in electrical theory, action and application of apparatus, principles of lighting, power circuits, etc., needed for the most intelligent and effective handling of this work.

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surate from that. Do you really think it's worth it? Wartime, too.

As your page numbers are marked at the bottom of the page, what serious harm are you afraid of that prevents you from marking it at the bottom of your editorial page? When it was customary to put page numbers at the top of the pages, some people with more artistic sense than efficiency did not want the opening appearance of a section spoiled by a page number, but even that consideration disappears if the page number is marked at the bottom.

Of course, this is the only such comment you have ever heard, though that does not mean that nobody else was annoyed by it, but only that not to the point of sitting down and giving the editor hell for it, and asking for hell in return.

A. BOYAJIAN, Pittsfield, Mass.

P. S.—DEAR MR. KNOWLTON:

This is for your benefit, not for publication. I don't know Mr. Williams. I like to take liberties only with people I know. Sincerely,

A. BOYAJIAN.

DEAR MR. BOYAJIAN:

Re yours of the 17th inst. addressed to A. E. Knowlton because you are not acquainted with S. B. Williams. Both gents being absent on editorial prowls and, although you and I are not on hand-holding terms either, I take upon myself the responsibility of answering your letter in kind.

In eighteen years of editing I have met many engineers. In a feeble sort of way I was one myself before I entered this wretched writing trade. Full many a time and oft an engineer has told me in simpering simulated modesty that he could not write. And now an epoch of real humility dawns! For the first time in my experience, and also I am sure in every other editor's, an engineer confesses that he cannot count!

"Oh frabjous day!
Calloo, callay!"

Perhaps I should not give way to such delirious glee. Maybe you are confessing only that you have trouble in counting. But even that must be a tremendous lightening of the weight of egoism that so firmly anchors the engineering soul in the fog-enveloped backwaters of the inferiority complex.

As to the case in hand, inability to count forward three numbers from 34 absolutely precludes, of course, competence to count one number backward from 38. Counting backward is so much more difficult.

It was no whim of the pale æsthete that pushed the folio identification from the top of the sheet to the bottom. It

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was efficiency—the same efficiency that engineers adore. A better utilization of space available for type is accomplished by having the folio line at the bottom. In order to avoid eye confusion with text and title type, the folio line must have a wider set-off at the top of the page than at the bottom. Thus it wastes space, and waste, so it is said, is an abomination to the engineer. You proclaim your devotion to efficiency and cavil at its manifestation. O, Pharisee!

And it was efficiency again that left the folio lines off pages 35 and 36. That sheet is an insert, printed in total volume for incorporation into many magazines. To have printed ELECTRICAL WORLD's folio lines on it would have required a separate press run, separate runs for all the magazines into which the sheet is bound.

Is this enough hell in return? I can give you more if you want it. But perhaps I should conclude for the nonce and give you opportunity to gather your forces for counter-attack. I am magnanimous. I do so.

Yours in verbal excoriation,
FRANK R. INNES, Managing Editor.

DEAR MR. INNES:

For a couple of fellows who never heard of each other until recently, we surely are getting acquainted at lightning speed. You have already found out about me something the boss has not been able to find out in many years—that I cannot count. And Doc has been telling me things about you, from your letter, that even the missus does not know. Doc is a psychoanalyst and as keen as Sherlock Holmes in reading volumes from scraps of evidence.

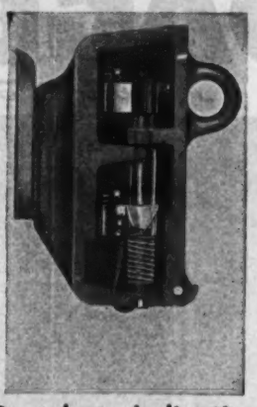
"What do you make of this, Doc?" I asked him, handing him your letter. After looking it over, he says, "Highly revealing. A long, uncensored letter. The fellow knocked the censor down to enjoy a spree of self-disclosure."

Doc has a theory that each one of us has a censor that keeps the subconscious in check. But the subconscious is crafty and frequently fools the censor. It is also violent at times, and knocks the censor cold. The censor is fooled by jokes, witticisms, informalities and "friendlinesses," and therefore these things are highly revealing about a person's subconscious, according to Doc.

"What did you write to him?" asks Doc.

I told him.

"Lazy and impatient, eh? You blew off a puff of steam then. The censor wouldn't let you mail that letter and you fooled him by putting in that note to Knowlton. It was ostensibly addressed to Knowlton, but actually addressed to your censor, and it suc-



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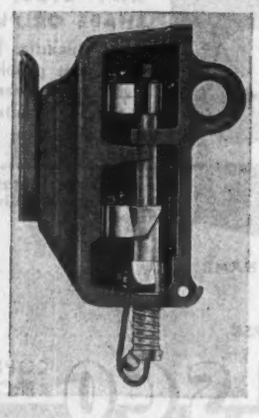

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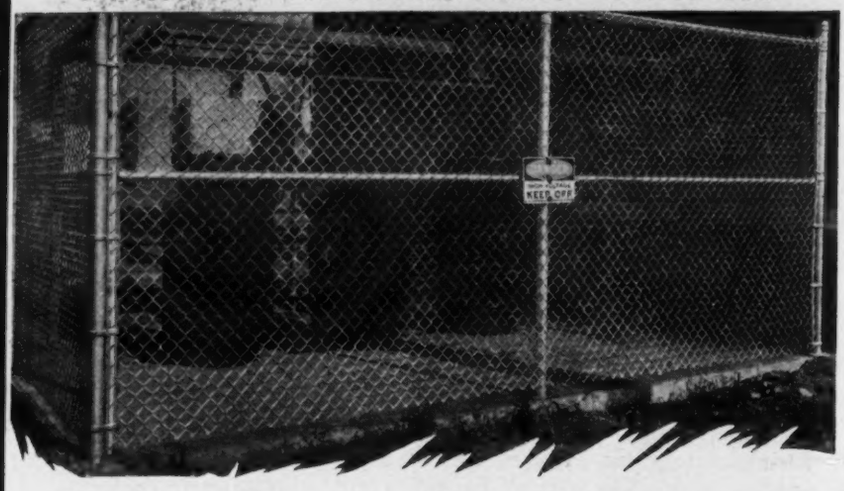

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ceeded in fooling the censor, and he let you mail the letter."

"Lay off of me, Doc, and analyze that letter," I says to him.

"What do you make of it yourself, Watson?" he asks.

"Simple," I said. "The fellow is peeved at me because I criticised his magazine."

"Wrong as usual," he says. "This man is not angry at you. He is deliriously jubilant, and he is grateful to you. If you were in New York he'd invite you to lunch."

"Yeah, jubilant because he thinks he got something on me," I says.

"Not on *you*, on an *engineer*, *any* engineer. You merely represent the engineering profession to him," he says.

"You mean this fellow has got a grudge against engineering?" I ask.

"Exactly. Some time in the past engineering inflicted a wound—a trauma—to his subconscious, and it has not healed up yet. That trauma has been nursed secretly, and every now and then it comes out in the open when the censor is fooled or knocked down."

"Where do you find all that, Doc?"

"The man is jubilant because engineers can neither write nor count. A compensation to his inferiority complex. Through a slip of the pen, he admits that there is an inferiority complex. Of course, he assigns it to you, but a psychologist knows all the tricks which the subconscious use so as to get expression."

"But why has he got a grudge against engineering?"

"We don't know the exact incidents. Once upon a time he was an engineer, probably a better-than-average engineer. Now he isn't. Why? Because he did not obtain in engineering the success he wanted. As he was ambitious and energetic, that left a wound in his subconscious. He drifted into the publicity end of things where he made a better success, though he received a wound there, too. In publicity two things count: One is ability to write, the other is getting the news. He got rebuffs in writing, which hurt him; but he was successful in getting the news because he was an aggressive mixer and news-getter to a degree which his friends would applaud and his enemies condemn as overaggressive. Through that he advanced to his present job, which is highly compensatory to his two inferiority complexes—inability to shine as an engineer and as a writer. Compensatory to his engineering complex, because he necessarily hires engineers, and compensatory to his writing complex because he hires editors. I bet you a cookie that he sometimes makes arbitrary trivial changes in what his editors write, as if to say, 'You fellows will never write a perfect editorial without my help.' His subordinates of course

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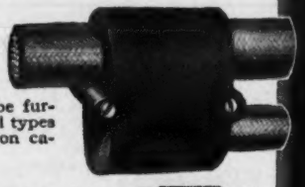

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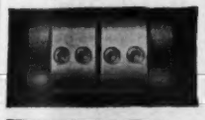

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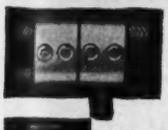

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tell him that his suggestions are a great improvement, and so he is happy for the moment, but the wound is not completely healed. You could not take that man away from his present position to another kind of a job by offering him a generous raise."

"Doc," says I, "where do you find all that? You're letting your imagination run wild."

"What point, for instance," he says.

"This for instance, that he was a better-than-average engineer?"

"It takes only a little energy, not brains, to be a better-than-average engineer, and he has the energy," answers Doc without so much as a wink.

"Where do you find that he did not shine as a writer and it left a trauma in his subconscious?"

"Three facts, of which any one alone would be sufficient evidence," he says. "First, he is jubilant that engineers cannot write by their own admission; second, he is challenging you (an engineer who is known not to be able to write) to a writing duel; third, the literary quality of his letter."

"I can understand the first two," I answered, "but not the third. I think his letter exhibits a good deal of literary atmosphere. He starts with a phrase of sex appeal such as hand-holding (that must have made his steno blush); then he breaks into poetry, and then the letter ends with a climax in which I am challenged to a writing duel. I couldn't write as well."

"That you couldn't write as well does not prove that he can write well," says Doc, without lifting a brow.

"Drop that," says I. "Where do you find this overaggressive business?"

"Well, his entry into this personal correspondence is great sociability through friendly eyes, overaggressiveness through critical eyes. He has a good excuse, of course. Then consider the slip of the tongue where he refers to his editors as being out "prowling." He is joking, of course, but you know

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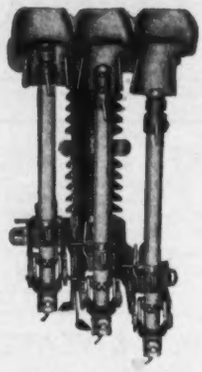

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THE J. G. WHITE ENGINEERING CORPORATION

Engineers — Constructors

New York, N. Y.

(or ought to know by this time) how revealing jokes can be when coupled with other evidence, because jokes easily slip by the censor. I should venture a guess that the strongest feature of his engineering magazine is the completeness and promptness of its engineering news, coupled with a relative shallowness of engineering theory."

"That's right, Doc," says I, "you are simply marvelous. Everything is all clear to me now. Tell me, though, what should I write to him?"

"Write him something nice, because he has nothing against you personally, and he wishes to make friends with you. Ignore his bark."

"I understand it now," says I. "I am not angry at him any more. If he were here, I'd invite him to dinner. I'm sorry for a man with two traumata in his subconscious. What soothing thing can I tell him?"

"You ought to know by this time that he likes to get something on engineers. So, confess to him that, let us say, engineers—you for one—are lazy. And that would be true. Meanwhile, this case will make another interesting addition to the many examples in my forthcoming book on 'Fooling the Censor.'"

So, my dear Mr. Innes, I confess to you that engineers—I for one—are lazy, so lazy that we go into all kinds of trouble to avoid a little labor. For instance, one lazy engineer, who thought it too much work to add, invented the adding machine. Others, too lazy to multiply, invented the slide-rule and the multiplying machines. Still another one, too lazy to write long-hand, invented the typewriter. The engineer thinks other people are lazy, too, like himself, and he has filled the world with labor-saving machinery. A man who works hard to avoid some little labor could also rightfully be called crazy. So we have a fuller indictment against the engineer:

He cannot write.
He cannot count.
He is lazy.
And is crazy

But, man, he is the creator of the modern world.

Yours in deep sympathy,
A. BOYAJIAN.

•

Sylvania Opens Sales Office in Philadelphia

Sylvania Electric Products, Inc., will open a new sales office in the Lincoln-Liberty Building at Broad and Chestnut Streets, Philadelphia, effective June 1. Garlan Morse will be manager of the new division, embracing metropolitan Philadelphia, eastern Pennsylvania, Delaware and adjoining sections of New Jersey.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : "OPPORTUNITIES" : EQUIPMENT
BUSINESS : : USED OR RESALE

UNDISPLAYED ——RATES—— DISPLAYED

10 CENTS A WORD. MINIMUM CHARGE $2.00.
Positions Wanted (full or part time salaried employment only) ½ the above rates payable in advance.
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NEW ADVERTISEMENTS received by Monday will appear in Saturday's issue, subject to limitations of space available.

WANTED

CHIEF ACCOUNTANT

for Municipal Utilities sober studious man with minimum five years utility accounting, draft exempt. Qualify $10,000 bond paid by us. Salary $325 monthly; also vacation, sick leave, pension, life insurance. Permanent. Pacific Northwest. Air mail qualifications and reference covering experience and character. One of the best hunting and fishing areas in the world.

P-538, Electrical World
68 Post Street, San Francisco, Calif.

Wanted: Superintendent of Power

Essential food production industry in lower Michigan is seeking a man with experience supervising a plant of 400 lb. pressure or higher. Age 38 to 60 or draft deferred, opportunity for advancement. Send particulars regarding positions held and salaries received; include picture. All correspondence confidential.

P-546, Electrical World
520 North Michigan Ave., Chicago, Ill.

WANTED

ELECTRIC MOTOR ENGINEER

A large mid-west organization wants an electrical engineer with experience in electrical fractional horsepower field. Work involves knowledge of design, production and costs in connection with small motors as applied to a variety of merchandise. Permanent position in development and testing laboratory. Should be college graduate and draft exempt. In reply give full details regarding age, education, experience and salary expected. All replies will be held in strict confidence. Those employed at their highest skills in war work not considered.

P-544, Electrical World
520 No. Michigan Ave., Chicago, Ill.

POSITION VACANT

DIVISION MANAGER—A company which has conformed to the intregration definition and is operating in a prosperous, rapidly growing territory desires an experienced division manager capable of taking complete charge of operating division containing approximately 21,000 electric customers. Knowledge of and experience in all phases of utility operations is essential with special emphasis upon ability to understand people and to operate in a manner sympathetic to the public interest. Prefer a man at least 40 years of age, experienced in utility operations in the South or Southwest. Territory contains good schools and colleges and living conditions are excellent. This is a permanent position with a solid company and should provide a lifetime of work. P-539, Electrical World, 520 N. Michigan Ave., Chicago, Ill

EMPLOYMENT SERVICE

SALARIED POSITIONS — This advertising service of 32 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. BIXBY, Inc., 262 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

MAN—age 38—20 years experience in Power plant, both steam and Hydro. Would like a position as manager or assistant manager of Hydro plant either private or municipal owned. Can give best of reference. PW-540, Electrical World, 330 W. 42nd St., New York, N. Y.

OPERATING SUPERINTENDENT. Experienced in Operation, Construction, Design, Maintenance and Research, Twenty-five years Public Utility Field. Age 51, married, one child. Desire permanent location. PW-543, Electrical World, 520 N. Michigan Ave., Chicago, Ill

ELECTRICAL DRAFTSMAN: Squad Leader, Draft Exempt, Executive Ability, 20 years experience in drafting, Design and Field Construction on Generating Stations, D.C. Rectifier Substations, Control Wiring, Line Construction—Distribution and Transmission, Industrial Control and Switchboards—can supply references from present and past employers—Desire Position with Post War Possibilities. Willing to travel anywhere. PW-548, Electrical World, 330 W. 42nd St., New York, N. Y.

To A Research Engineer with Ideas

We are a relatively young but fast growing concern in the Middle West, specializing in transmission and distribution equipment. We have a small but most modern plant and a fine research department. We flatter ourselves for being aggressive merchandisers.

We are looking at present for an electrical engineer of resourcefulness to help us in the design of new equipment for the electrical utility industry. He should have some practical experience but mainly a lot of sound imagination and ideas.

To such a man we can offer a very satisfactory income, an excellent opportunity for promotion and a permanent connection with a financially strong organization.

If you feel you meet these qualifications and if you are not now in a full time war job, we wish you would write us. We might have just what you had always hoped for.

P-547, Electrical World
520 N. Michigan Ave., Chicago, Ill.

(Additional Employment & Business Opportunity Advertising continued on the following page)

WANTED

SALES ENGINEER

Unusual opportunity for electrical engineer to sell high frequency heating equipment involving industrial application engineering on essential war work.

Permanent position with unlimited future at substantial salary. Give complete information regarding age, education and experience. Address

SW-545, Electrical World
520 No. Michigan Ave., Chicago, Ill.

SALES ENGINEERS WANTED

WITH electrical engineering background and knowledge of electrical distribution practice. This opportunity will be of permanent nature and is with a leading manufacturer in the electrical distribution manufacturing business established on a national basis. Successful applicant will act as specialist working with company representatives now well acquainted with utilities and other customers. Location, Middle West.

Address **SW-549,** Electrical World, 520 N. Michigan Ave., Chicago, Ill.

POST-WAR COLLABORATION:
British Engineering Company having three factories (light, medium, heavy) desires to collaborate with American Manufacturer/s for post-war production. Presently occupied electrical accessories, heavy air-blast switchgear, welded fabrications, and aircraft. Alternative lines of production to the above, Plastics, Air-conditioning, Small Compressors. Prepared to receive applications for spare time Electrical Engineering correspondent. Apply Box C 3058 c/o. **W. H. Smith & Son, Ltd., Manchester 3, England.**

WANTED

FOR SALE

(additional For Sale ads on opposite page)

-TRANSFORMERS-

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Prices quoted on request.

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"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
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30 Church St., New York

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Testing Meters Needed For War Service

We need high-quality, portable indicating instruments for the testing of electrical equipment for U. S. Navy. We will buy, or rent for the duration, the following instruments having ¼% accuracy.

A-C Dynamometer-Type Voltmeter, for 0-500 volt service with or without external resistance box;

Polyphase Power Factor Meter; Polyphase Wattmeter, 5-10 ampere coils for 500 volts;

D-C Millivoltmeter, 0-100 M.V. scale;

D-C Voltmeter, 0-300 scale.

If any engineering schools have spare instruments to rent, we will guarantee to return them at end of our contract period in good condition or to replace with new instruments of equal quality.

I-T-E Circuit Breaker Co.
501 No. 19th St., Philadelphia, Pa.

IF there is anything you want . . .

that other readers of this paper can supply

or— something you don't want

that other readers can use, advertise it in the

SEARCHLIGHT SECTION

DIESEL ENGINES FOR SALE

1 Ruston-Hornsby horizontal (310 rpm) 4 cycle, continuous duty, 34/38 BHP cap. with 23/26 KW (29/34 KVA) 3 phase, 120/208 V generator with direct connected exciter and slide base.

1 Ruston-Hornsby horizontal (320 rpm) 4 cycle, continuous duty, 28/31 BHP cap. with 18/21 KW (22/25 KVA) 3 phase, 120/208 V generator with direct connected exciter and slide base.

Above is complete with automatic voltage regulators, complete switchboard, water pump, safety devices, alarm system, automatic oil system, filters, etc. Equipment installed new in 1941; used slightly over one year.

TRANSFORMERS FOR SALE

3 Pennsylvania 25 KVA, 3 phase, 2 to 1 ratio; rebuilt within past month.

No Priority Necessary

ECONOMY GROCERY STORES CORP.
Engineering Department
100 Business Street **Hyde Park, Mass.**

FOR SALE

SYNCHRONOUS MOTOR

5000 Kv-a. 25 cycle, 3 phase, 300 R.P.M., 13200 volts, horizontal type synchronous condenser with belt driven exciter and 100 HP. starting induction motor, and high pressure oil pump for bearings.

Originally part of 25/60 cycle frequency changer set and presumably can be used as either generator or motor.

For further information apply to Purchasing Agent

THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO
620 University Avenue Toronto, Ontario

WANTED

HYDRAULIC TURBO-GENERATOR

Preferably 110 foot head, 5000 K.W., 3 phase, 60 cycle, with switchboard, etc. Will consider offers of any part or anything over 2500 K.W.

W-550, Electrical World
330 West 42 St., New York City

SUCCESSFUL OPERATION GUARANTEED

Every Machine in This Ad is Owned Outright By Us

D C MOTORS

	HP	Make	Type	Volts	Speed
1—	1500	Whse.		550	330
3—	1250	G.E.	MPC	550	130
1—	800	G.E.	MPC	600	600
1—	625	G.E.	MPC	500	130
1—	600	G.E.	MPC	600	650/900
1—	600	Whse.		250	150/275
1—	350	G.E.	MPC	230	450
1—	300	G.E.	DMC	230	400/600
1—	300	Cr. Wh.	CMC	230	1150
1—	300	G.E.	MPC	230	275/550
1—	270	Whse.		500	250/400
1—	250	Al. Ch.		230	525
2—	200	Whse.		230	400
1—	175	Whse.	SK	250	150/525
1—	150	G.E.	RC-19A	230	800/1000
1—	150	Whse.	SK-201	230	300/900
1—	150	G.E.	MPC	230	250/450
2—	125	G.E.	CO-1832	230	625
3—	120	Whse.	SK-180	230	720
3—	100	G.E.	LC-50	230	1200
1—	100	Al. Ch.		230	950/1150
2—	100	G.E.	RC-19	230	575/720
1—	75	G.E.	LC	230	500/1000
1—	75	Whse.	SK	230	475/900
1—	60	El. Dy.	2S8	230	525/1050
3—	50/60	Cr. Wh.	65H	230	500/1000
4—	50	G.E.	RC-16	230	650/815

TRANSFORMERS

	KVA	Make	PH	Type	Voltages
3—	1000	Pitts.	1	OISC	2300/4600x575
3—	1000	G.E.	1	HKDD	13800x2300
3—	300	G.E.	1	H	13200x2300/575
2—	200	Whse.	1	SK	6900x230/460
3—	200	G.E.	1	H	26400x115/460
9—	100	Whse.	1	OISC	13200x250

GEAR UNITS

1—2100 HP Whse., 1800/375 RPM.
1—943 HP GE 5306/1200 RPM.
1—720 HP DeLaval 3600/600 RPM.

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1500 KW GE 600 V. DC, Gen. dc. to 2100 HP—6600 V. Syn. Motor with exciter.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
2—250 KW GE 250 V. Gen. d.c. to 375 HP—2200 V. Syn. Motor.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.
1—500 KW, G.E., 625 KVA, 2300 V., 3 ph., 60 cy. generator with Curtis 4 stage, 150 pound condensing turbine complete with condenser, etc.

ROTARY CONVERTERS

60 cycle

2—1500 KW, Whse. 720 RPM 650 V. DC with 3-single phase, 33000 V. transformers and panel.
1—1250 KW, G.E., 720 RPM 250 V. DC with 1375 KVA, 3 ph., 2300 V. Transformers and Panels.
2—750 KW, Whse. 1200 RPM, 600 V. DC with 2300/6600/11000 volts Transformers and Panels.
1—750 KW, Whse. 720 RPM 250 V. DC with three phase 6600/2300 V. Transformer and Panels.
1—375 KW, Whse. 1200 RPM 250/275 V. DC with 2200/6600 V. Transformer and Panels.
1—300 KW, G.E., type HCC, 1200 RPM, DC, 600 V. AC 6 ph., 1200 RPM.

25 cycle

3—1500 KW, G.E., 225/275 V. DC Booster type each with 1600 KVA, 3 ph. 6765 volt Transformers and Panels.
1—500 KW, G.E., 225/275 DC Booster type with 500 KVA 3 ph. 6765 volt Transformer and Panels.

A. C. MOTORS

3 ph. 60 cycle

Synchronous

	HP	Make	Type	Volts	Speed
1—	500	G.E.	TS	440	360
1—	250	G.E.	ATI	220	450
1—	225	G.E.	ATI	240	600
1—	200	Whse.		440	514
1—	150	G.E.	TRB	220x440	450
1—	150	Whse.	G	2300	900
1—	150	Whse.		2200/550	1800
1—	125	G.E.	ATI	240	257

Slip Ring

1—	800	Al. Ch.		440	885
1—	600	G.E.	IM	2200	900
1—	450	Whse.	CW	2200	875
1—	400	G.E.	MT	550/440	300
1—	400	Al. Ch.		2300	505
1—	400	Al. Ch.		440	1200
1—	350	G.E.	IM	2300/4000	257
1—	300	G.E.	IM	2300	585
1—	250	G.E.	MT-410	2300	400
1—	250	G.E.	MT	4000/2300	257
2—	200	Whse.	CW	2200	514

Squirrel Cage

1—	500	G.E.	1-17B	2200	695
1—	300	Whse.	CS	550	580
2—	300	G.E.	1K	2300	600
1—	300	Al. Ch.		2200	1160
1—	250	Al. Ch.		220/440	1150

SINE WAVE SET

Main unit—GE 3 unit, 4 Brg. consisting of motor—15/35 HP. 750/1800 RPM. 230 V. DC Gen.—15 KW—220/110 V., 1800 RPM—3 ph., 60 cy.
Ref. Gen.—5 KW—30/18 V., 1800 RPM, 3 ph., 60 cy., with stator shifting.
Complete with Exciter Set, Voltage regulator, panels and accessories.

RE-NU-BILT BELYEA MOTORS

What are your requirements? units up to 5000 kw available in stock.

BELYEA COMPANY INC.

Main Office & Shop: 51 HOWELL ST., JERSEY CITY, N. J.

J. L. HEMPHILL & CO. Inc.

ELECTRICAL ENGINEERS AND EQUIPMENT

600-650 53rd Street, North Bergen, N. J.

N. Y. C. Tel.: LOngacre 5-8227—N. J. Tel.: UNion 3-2600

MOTOR—3 PHASE 60 CYCLE

1—5000 ampere, 6 volt, Hanson-Van Winkle
1—2000 ampere, 6 volt, Hanson-Van Winkle
1—1500 ampere, 6 volt, Hanson-Van Winkle
1—500 HP, 900 RPM, 440 volt Lincoln slip ring.
1—400 HP, 514 RPM, 440 volt, Westg., slip ring.
1—335 HP, 600 RPM, 2300 volt, G.E. syn.
1—300 HP, 720 RPM, 2200 volt, G.E., sl. rg.
1—250 HP 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v. G.E., sl. rg.
1—150 HP, 1800 RPM, 2300 volt, Al. Ch. sq. cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
2— 75 HP, 1200 RPM, 2200 volt, G.E., vertical.

MOTORS—D. C. 230 VOLTS

2—450 HP, 400 RPM, General Electric MPL.
1—250 HP, 700 RPM, Electro Dynamic.
2—150 HP, 850 RPM, Westinghouse, SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1— 65 HP, 1000 RPM, G.E., type BC.
1— 50 HP, RPM, Westinghouse, type SK.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, General Electric 6600/2200/220/440
3—200 KVA, General Electric 2200/220/440
3—200 KVA, G.E., 2200-220/440 volts
3—150 KVA, G.E. 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
3—100 KVA, G.E., 2200-220/110 volts
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3— 75 KVA, General Electric 2200/220 440

MOTORS GENERATOR SETS

1—750 KW, 250 volt Allis-Chalmers synchronous
1— 35 KW, 125 volt Electric Machinery sq. cage

MOTORS—VARIABLE SPEED 230 VOLTS

1—750 KW, 250 volt Allis-Chalmers synchronous
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chalmers

TURBO-GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW G.E., 3 ph., 60 cy., 220 volt, cond.

ENGINE GENERATOR SETS

1—150 KVA, General Electric Generator, Ames uniflow engine.
1—62½ KVA, Westinghouse Generator, Fairbanks Company engine.

Complete Line of A.C. and D.C. Motors and Generators

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies.

POWER PLANT EQUIPMENT
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TRANSMISSION LINE MATERIALS

Send for new list, . . . to

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EBASCO SERVICES INCORPORATED
Two Rector St. New York, N. Y.

"Opportunity" Advertising:
Think
"SEARCHLIGHT"
First

FOR SALE
COMPLETE DIESEL ELECTRIC POWER PLANT

2—35 KW 120-240 V D.C. 1200 R.P.M. Ideal Electric—Buda-anova. 240 V Storage Batteries—All Auxiliaries. Switchboard—Appurtenances.

7½ K.V.A. AC-DC M. G. Set

Apply **734 Eighth Ave., N. Y. C., N. Y.**

1000 KW Frequency Changer Set
25 to 60 cycles
60 cycle unit—4150 V, 25 cycle unit—9000 V
Complete with starting equipment
IRON & STEEL PRODUCTS, INC.
13438 S. Brainard Ave. Chicago, Illinois
"*Anything* containing IRON or STEEL"

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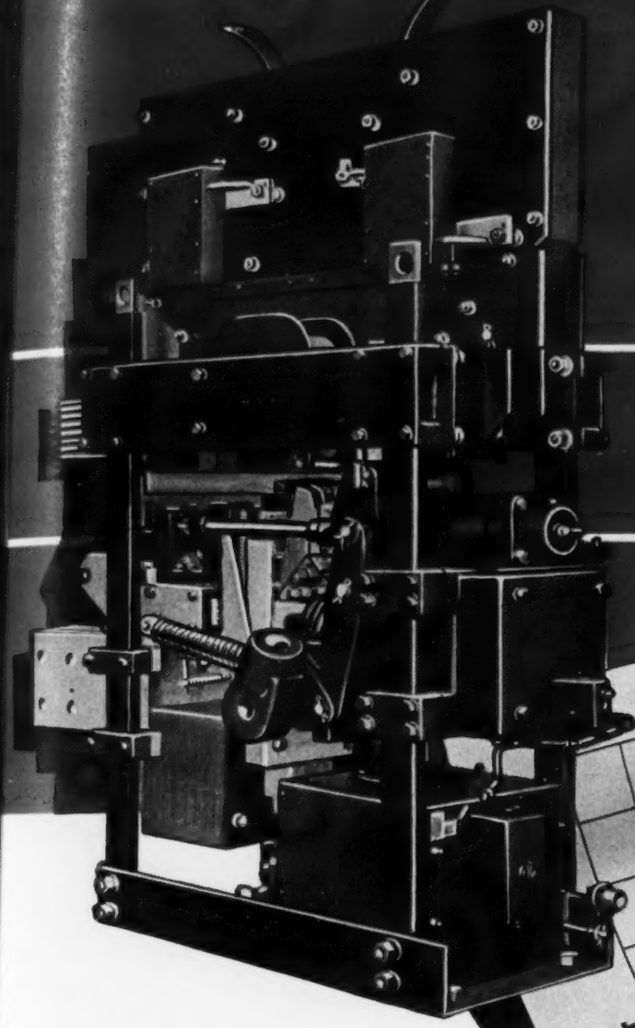
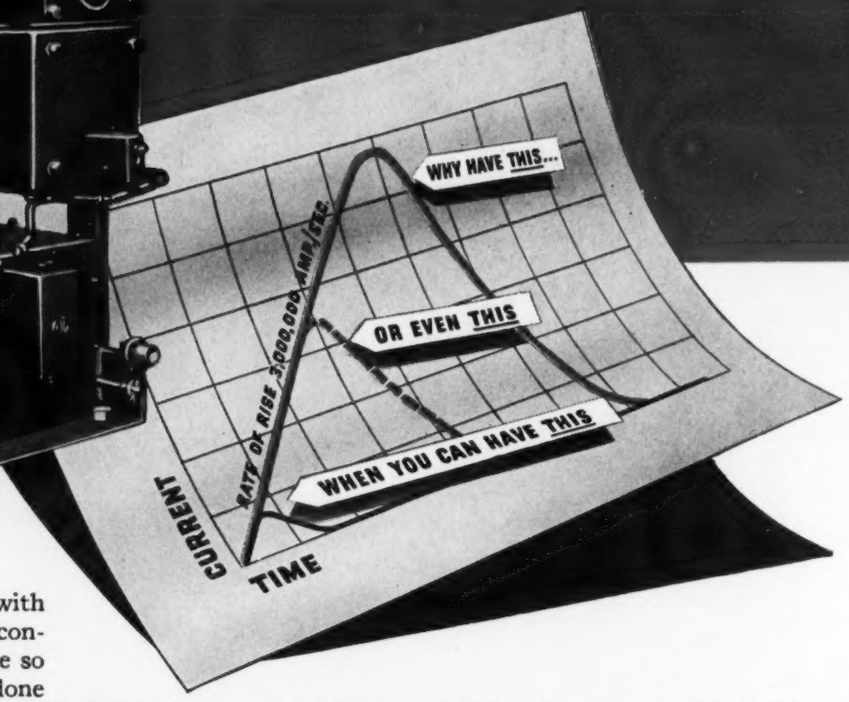
★ These companies have supplied additional buying information on their products in the 1943 edition of the Electrical Buyers' Reference

On d-c motor drives...

FAULT CURRENTS CAN BE KEPT LOW



This ultra-high-speed circuit breaker is so fast that fault currents can't rise to dangerous values.



ON PRESENT DAY d-c systems with generators, converters or rectifiers connected in parallel, fault currents rise so rapidly that serious damage may be done before a conventional circuit breaker can limit the current. Ordinarily the circuit breaker will open in 3 cycles, in special cases in 1½ cycles, but with fault currents rising at a rate of several million amperes per second, such opening times permit flash-overs to burn brushes and brush-holders. Damage is done; production is stopped for repairs or replacements.

ULTRA-FAST OPENING IS THE ANSWER

The way to protect a system against the effects of rapidly rising currents is to hold the peaks to safe values. I-T-E does this with fast-opening circuit breakers. The Type FB circuit breaker, illustrated, has opening characteristics which limit currents within 2/5ths of a cycle (60 cycle basis).

IMPORTANT SAVING OF MATERIALS

When high fault currents are to be encountered, bus structures must be built with heavy conductors and heavy bracing. On the other hand, when peak currents are kept low by ultra-fast circuit breakers, much metal is saved; buses are much simpler.

HIGH-SPEED CIRCUIT BREAKERS HAVE PROVED THEIR VALUE

I-T-E has high-speed circuit breakers in service. They are new but their record is well-founded. Our engineers will gladly tell you about them.

I-T-E

AIR SWITCHGEAR

IMMERSED IN AIR • ENCASED IN STEEL

Representatives in Principal Cities

CIRCUIT BREAKER CO., PHILADELPHIA, PA.

Thousands of Kuhlman Transformers have proven their ability to stand up on the job •

There isn't a state in the union in which Kuhlman Transformers are not on the job—distributing power 24 hours a day, in all kinds of climates, in all kinds of weather 365 days a year. Kuhlman Transformers have proven over a period of forty-seven years that they have what it takes to stand up on the job. The Kuhlman B. I. (Bent Iron) core results in lower exciting currents, reduced weight and better all-around operating characteristics. The copper bearing steel tanks effectively resist the havoc of rust and corrosion. The pockets for primary and secondary bushings, pressed into the tank, protect the bushing seats from the weather. And both primary and secondary bushings are sturdily constructed to prevent breakage.

In fact, each component part of a Kuhlman Distribution Transformer is designed and built to take more punishment than it will ever be subjected to in actual service.

In addition to Standard Distribution and Power Transformers, Kuhlman builds a complete line of C.S.P., Saf-T-Kuhl and Dry-type Transformers and Line Regulators. Write today for complete facts about any or all of these Kuhlman products.

Kuhlman

ELECTRIC CO[illegible]

BAY CITY, MICH[illegible]